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TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK.....385, 390
A High-Duty Pumping Engine for a Plant of 52 Hydraulic Elevators (illustrated) 386
Uniform Symbols for Engineering Formulas..... 387
Comparative Tests of Steam Boilers with Different Kinds of Coal 387
The Chicago Main Drainage Channel, XXII. (with inset, illustrated) 387
The New Engineering Building of Purdue University (illustrated) 389
Effect of Temperature on Strength of Wrought Iron and Steel (illustrated) 389
The Experimental Water-Filter Tank at Pittsburg, Pa. (illustrated) 390
Rate of Working of British Naval Boilers..... 391
Tests of the Strength of a New Fireproof Floor (illustrated)..... 396
Performance of Locomotives of the Columbia Type, Philadelphia & Reading R. R..... 396
Wide Fireboxes for Locomotives..... 397
Changes of Line on the Pennsylvania R. R. (illustrated) 398
Effective Center of Light Emitted from a Standard Photometric Burner (illustrated) 399
Annual Meeting of the American Society of Mechanical Engineers 400
EDITORIAL NOTES 392
The Value of Street Railway Franchises—The Proper Method of Protecting Drawbridge Openings on Electric Railways—An English Tribute to the American Consular Service—Monumenting the Public Land Surveys—The Effect of Temperature on the Strength of Wrought Iron and Steel—Proper Nomenclature for Motor Wagons.
EDITORIAL:
Methods of Work on the Chicago Main Drainage Channel 393
LETTERS TO THE EDITOR 395
The Proper Consistency of Concrete after Mixing—Calorimetric Pyrometers—Performance of a Sea-Going Hopper Dredge on the Columbia River—Notes and Queries.

The new cable incline railway up Lookout Mountain, Chattanooga, Tenn., has been completed, and is 4,792 ft. long, with a rise of 1,450 ft., or about 30% average grade. The minimum grade is 12%, and the maximum 68% for 200 ft. at the summit. The maximum grades of other cable inclines are 66.6% at Bridgnorth (England), 63% at Mount Vesuvius (Italy), 62% on the Stanserhorn Ry. (Switzerland), and at Mount Wilson (California), and 60% at San Salvatore (Switzerland). The new incline has two 75-HP. hoisting engines, with 7½-ft. drums driven by gearing. Steam is supplied by three boilers. The cars are 32 ft. long and 8 ft. wide, resembling ordinary railway cars but having the floor built in steps, with seats set to accommodate passengers on the grade. There are two 1¼-in. steel cables, attached to the car by equalizing bars, so that in case of breakage a grip-brake takes hold of the timber guard rails. The line is partly in earthwork and partly on trestles, laid with 56-lb. rails, the lower part of the line having two rails and the upper part (above the four-rail passing place) three rails, the wheel flanges being so arranged that each car takes the left hand track. Mr. Linn White, of Chattanooga, was the engineer, and Mr. John T. Crass, the contractor.

A concession for a railway from Pekin, China, to tidewater is reported as having been granted to an American syndicate. The road would be about 200 miles long, running over a level country, and the estimated cost is about $35,000 per mile. It would tap a valuable coal field. Mr. A. W. Bash, ex-Collector of Customs of Port Townsend, Wash., is credited with having conceived the plan, and in connection with the Hon. John W. Foster, laid the scheme before Li Hung Chang, and finally obtained the concession. Among the men of prominence said to be interested are Senator Calvin S. Brice, Hon. Whitelaw Reid and Hon. John W. Foster. Mr. Bash is now on his way to China with two civil engineers to prepare full plans and estimates, says a Port Townsend despatch. The Chinese Government is to indorse the bonds and guarantee a stated annual interest for 20 years.

A combination parlor, sleeping and dining car, owned by the American Palace Car Co., of Boston, is running between Boston and Atlanta. The berths and bedding are stowed in the space between the double floors, and the dining tables and equipment in lockers between the windows, the car being fitted with rattan chairs during the day.

Continuous brakes are now applied to 99.6% of the locomotives and 99.3% of the passenger rolling stock of railways in Great Britain, but these percentages include the engines fitted only with apparatus for working the train brakes, and cars fitted only with piping for connecting to braked cars. About 86% of the locomotives have driving wheel brakes, and 94% of the cars are fitted with brakes. The brakes used are as follows:

	Locomotives.	Cars.
Vacuum automatic	8,341	44,145
Westinghouse automatic	2,911	19,320
Smith's vacuum	6	19
Fay, Newall and Fay & Newall	...	7
Chain	...	4
Total	11,258	64,095
Not fitted with continuous brakes	41	415

A car lighted by electricity on the Moskowitz system has recently been run on the Pennsylvania R. R. It has a dynamo mounted on one of the car axles, supplying current direct to 36 lights and to storage batteries which in seven hours' run are charged sufficiently to light the car for 12 hours.

The second electric locomotive of the Belt line tunnel at Baltimore, Md., has been put in service, and hauled a train of 28 loaded freight cars, two steam locomotives, not working, and a caboose, at a speed of 20 to 23 miles per hour. The train load was about 1,400 tons.

The car coupler suit brought by the St. Louis Car Coupler Co., of St. Louis, Mo., against the Shickle, Harrison & Howard Co., for infringing its patents by making knuckles to be used in the St. Louis couplers, has been decided in favor of the coupler company. The court held that the knuckle is a special feature of the coupler that can only be used in connection with the coupler as a whole, and that it can only be manufactured by the owners of the patent or person licensed by them.

The most serious railway accident of the week was a derailment of an engine on the Harlem River branch of the New York, New Haven & Hartford R. R., near Port Morris, N. Y., on Dec. 8. The engine was on its way to pick up a freight train at Van Ness when it jumped the track, on a sharp curve, ran across the other track, and rolled down the bank, landing on its side. There were six men on the engine, going out to take charge of the train, and three were killed and three slightly injured.——A serious head collision between an eastbound Chicago express and a westbound freight train occurred Nov. 25 on the Atchison, Topeka & Santa Fe R. R., 28 miles south of Las Vegas, N. M. The engines and a mail car were wrecked, and two cars went down the bank into the Mora Creek. Two mail clerks were killed, two trainmen fatally injured, and about 17 other persons more or less injured.——A collision of freight trains occurred on the Illinois Central R. R. at Torrance, Miss., Dec. 2. A northbound freight train was taking the side track, but had not passed the clearance post, and the rear cars were struck by the southbound train, the engineman of which was killed.

The steamer "Principia," of the Arrow Line, from Shields for New York, was wrecked at the Faroe Islands, off the north of Scotland, Nov. 16, and 27 of the crew were lost, only one man being saved. The cargo was on fire and the ship had been turned to run before the wind, so that the smoke blowing ahead made navigation difficult. The vessel struck a rock and sank at once in deep water. It was a single screw steamer of 2,750 tons, built in 1888, and was 316 ft. long and 39 ft. beam.

An explosion of gas in a sewer occurred on Broadway, Milwaukee, Wis., Nov. 27. Three manhole covers were blown off, but nobody was injured.

Natural gas is used as fuel under the boilers of the steam heating systems in 17 of the public schools of Chicago. An explosion of gas took place under one of the boilers in June last, blowing out a brick wall and the boiler front. The Chief Engineer of the Board of Education has made two reports on the subject, in both of which he advocates the abandonment of the use of natural gas, and a return to coal fuel. It is doubtful if his recommendation will be adopted, for it appears that natural gas is used in schools over a large section of country, and accidents with it are no more common than with illuminating gas.

Wood paving with karri wood blocks from West Australia is now being laid on West 20th St., New York city, by the American Torbay Karri Wood Pavement Co., of 114 Fifth Ave., New York. The blocks are 9 × 4 × 3 ins., laid on edge on a concrete foundation, and the bottom of each block is dipped in hot tar to a depth of about 1 in. before the block is put in position. These blocks are largely used in London and other foreign cities, and are said to resist wear very well, but there seems to be no difficulty in splitting them with a hatchet for fitting round manhole covers, etc. The outside is a dark russet brown, but the inside is a dark crimson color when freshly split.

Work on the Northwest water-works tunnel for the city of Chicago has been commenced, and it is expected that the entire structure will be completed in two years. Altogether there will be 12 miles of tunnel, about 9 miles of which will be land tunnel and 3 miles of tunnel under Lake Michigan. The lake tunnel and about 1½ miles of the land tunnel, comprising the main line, will be 10 ft. in diameter, and the remainder of the land tunnel will be 8 ft. in diameter. The contracts for the land tunnel have already been let, and that for the lake tunnel will probably be let in about 30 days. The new tunnel will cost about $4,500,000.

An appeal to the highest court has been made in the mechanical filter suit between the National Water Purifying Co. and the New Orleans Water-Works Co., noted in our issue of Nov. 21. The local court decided that the latter company need not accept the 14,000,000-gallon plant built by the company, the suit being for $134,500, the contract price for the plant.

The Shaw tubular well patent is again before U. S. Commissioner Shields, in the case of Jehyleman Shaw, of Bridgeport, Conn., against Andrews Bros., of Brooklyn. The action is brought on account of royalties received from the city of Brooklyn, profits made on other contracts, and an alleged "deal" with Brooklyn politicians.

The Washington water-works tunnel, and the recent report upon it by Major Knight, Corps of Engineers, U. S. A., will be examined and reported upon by a board of consulting engineers appointed by General Craighill, Chief of Engineers, U. S. A. This board consists of Major W. E. Marshall and Capt. J. L. Luck, Corps of Engineers, U. S. A., and Mr. Alphonse Fteley, Chief Engineer of the new Croton aqueduct, and Mr. Desmond Fitzgerald, Resident Engineer, additional supply, Boston water-works, both of the latter Members of the American Society of Civil Engineers. This board is to consider the question of the cheapest and best method of conducting the water of the Potomac River from the Georgetown reservoir to the Howard University distributing reservoir, north of Washington, and to either devise means for the completion of the now abandoned tunnel, or the construction of an entirely new line of conduits. Major Knight has reported that it is feasible to repair and utilize the tunnel at a cost of about $900,000, but the tunnel would be objectionable on account of its inaccessibility and peculiar physical conditions, and it is understood that an entirely new pipe system could be constructed for but little more money that would be decidedly more desirable. This is one of the chief questions the Board will have to decide.

Engineers are wanted for the topographical survey of the 16,000 acres of Westchester county annexed to New York city and county by the operation of the law of 1895. This new territory is part of the 24th ward, and in its street improvement comes under the jurisdiction of Street Commissioner Louis F. Haffen. Anticipating difficulty in obtaining men of the experience and character needed by applying in the ordinary manner to the Civil Service Commission, Mr. Haffen has requested the authorities of the Columbia School of Mines, the Rensselaer Polytechnic Institute, the University of the City of New York, the College of the City of New York, the Stevens Institute, and the Smithsonian Institute, of Washington, to recommend to him graduates who would like employment as assistant engineers, assistants, transit men and topographical draftsmen. It appears that the latter class are particularly hard to get at present. Before appointment, it will be necessary for all candidates to pass a civil service examination, and this examination will be held in New York on or about Dec. 18.

The proposed enlargement of Lincoln Park, Chicago, Ill., by reclaiming some 415 acres of land from Lake Michigan is explained in somewhat more detail by the recent proceedings of the Lincoln Park Commissioners. The strip of land which is to be taken from the lake extends from Grace St., on the south, to Devon Ave. on the north, a distance of about 3½ miles, and it will vary in width from 1,100 ft. at Grace St. to 1,350 ft. about midway, and thence to 950 ft. at Devon Ave. A roadway 212 ft. wide will follow the shore line. According to reports, the Commissioners will appropriate about $50,000 a year for the work at present, and will first begin work on the sea wall.

The Commissioners of the new East River Bridge are reported as favorably considering a proposition to buy out the Uhlmann franchise, the majority believing that if this can be done upon equitable terms it would be best for the progress and future of the new bridge. At the last executive session Messrs. E. G. Freeman and E. D. Knapp were appointed to positions on the engineering staff.

The Grays Ferry drawbridge, over the Schuylkill River in Philadelphia, broke down on Dec. 4. The present draw was built in 1863. It was peculiar in being telescopic, the draw span sliding within one of the fixed spans. The bridge has long been entirely inadequate for the traffic demands put upon it, and the City Councils have been considering an appropriation of $250,000 for a new bridge, to which the Pennsylvania R. R. Co. and the Philadelphia Traction Co., now using the structure, were to add $150,000 each.

A HIGH-DUTY PUMPING ENGINE FOR A PLANT OF 52 HYDRAULIC ELEVATORS.

We illustrate herewith a high-duty pumping engine, built by the Laidlaw-Dunn-Gordon Co., of Cincinnati, O., to operate a plant of 52 hydraulic freight elevators at "Cupples Station," St. Louis, Mo. This engine has several features of interest in its construction, but is chiefly notable for the economy with which it will have to be operated against a heavy load. Briefly stated, it will pump into an accumulator against a pressure of 750 lbs. per sq. in., with a steam pressure of 125 lbs. per sq. in.

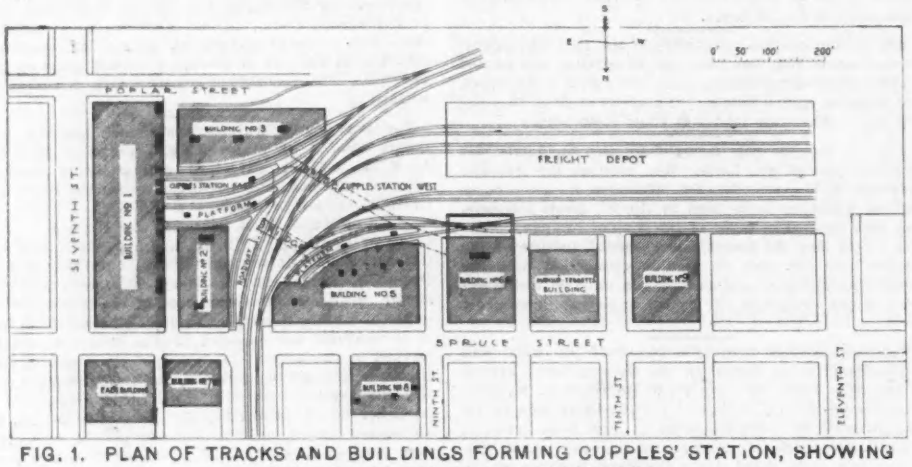


FIG. 1. PLAN OF TRACKS AND BUILDINGS FORMING CUPPLES' STATION, SHOWING LOCATION OF HYDRAULIC ELEVATORS.
Crane Elevator Co., Chicago, Ill., Builders of Elevators.

"Cupples Station," at which the elevator plant is located, consists of a group of wholesale houses having a common railway terminal and clearing-house system for receiving and shipping their goods. These wholesale houses are located, as shown by Fig. 1, on both sides of the Terminal R. R. Association's tracks, which connect with all the railways entering the city of St. Louis, Mo. As will be seen, the tracks in some cases pass through the basement of the buildings, and in all cases are provided with platforms at this level. The elevators shown by the dark squares are used to convey the goods between the car level platforms and the upper stories of the buildings. Large hand trucks are used to haul the goods from place to place on the same level. Described in a few words, the goods are received by train, unloaded, hoisted to the proper floor, and deposited, by a "station force" at the door of the tenant of any one of the buildings to whom they are consigned. The process of shipping goods is, of course, just the reverse of the receiving process. It should be borne in mind that there is no relation between the score or more of tenants, except that they are served by a common station force, which receives and ships their goods. The foregoing will explain the use of the elevator plant sufficiently well for present purposes, but for those who desire it, a more general description of the Cupples clearing-house will be found in Engineering News, Nov. 14, 1895.

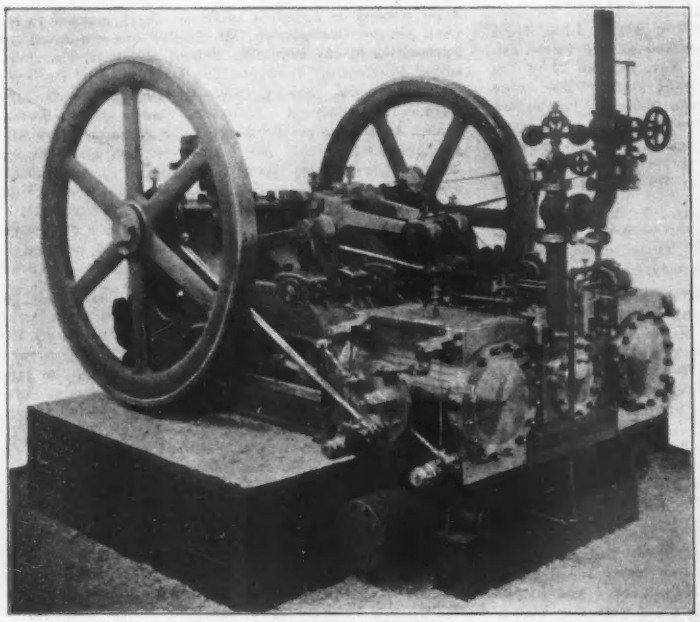
The general location of the elevators is shown by the black squares on the plan, Fig. 1. As stated, there are altogether 52 elevators, and they are all operated from an accumulator and pumping engine located in the west end of building No. 3. From the power plant the pipes are carried through conduits or tunnels to various points, where they branch off to serve different groups of elevators. The tunnels are centrally located, so that connections and branches can be easily made as the elevator system develops. This piping and the various elevators and their machinery have been installed by the Crane Elevator Co., of Chicago, Ill., which we understand has promised that the cost of operation shall not exceed 7 cts. per elevator per day.

Turning now to the pumping engine supplying power for operating the elevators, its general appearance is shown by Figs. 2 and 3. As will be seen, the engine is of the rotative, horizontal, fly-wheel type, with the piston of each steam cylinder operating a single-acting plunger pump. The pistons are direct connected with the plungers by crossheads, and their motion is conveyed to the crank shaft by steel beams connected to the cross-heads by links and to the crankshaft by connecting rods.

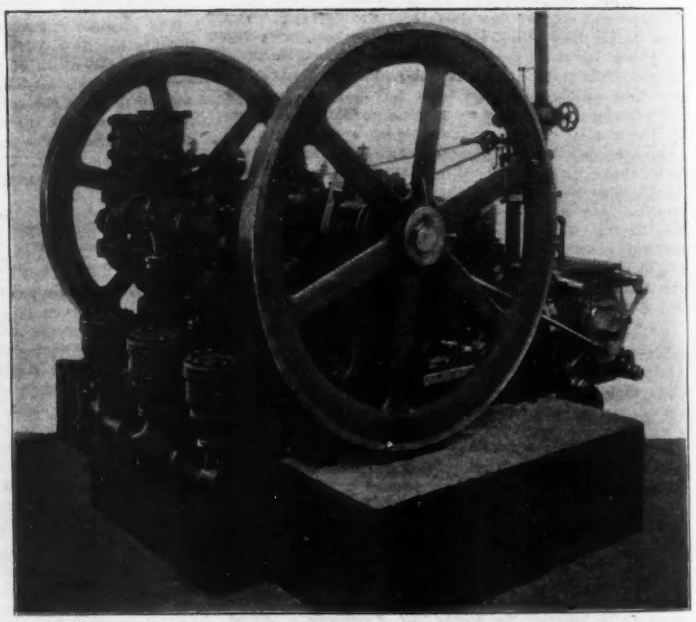
The steam end of the engine consists of a 13 × 24-in. high-pressure cylinder, with a 20 × 24-in. low-pressure cylinder on each side of it, or three cylinders altogether. The high-pressure cylinder has four Corliss valves placed vertical with all the moving parts, as links, wrist pin, etc., on the top of the cylinder. The valves on the low-pressure cylinders are set with a fixed cut-off at half stroke but otherwise they are of the Corliss style. There are four in number for each cylinder, and are placed at the side of the cylinder in the usual manner. All four valves on each cylinder derive their motion from a single wrist pin operated through a lever connected with an eccentric on the crank-shaft. The high-pressure cylinder exhausts into a receiver placed below the floor between the two low-pressure cylinders, and the exhaust steam is there re-heated by means of a copper coil in the receiver, before it enters the low-pressure cylinders.

The pistons are of the bull-ring type, and have a 2¾-in. steel rod fastened by a slight taper and a nut. The fastening of the rod to a crosshead is made with a key. The crossheads are of steel, and have pins or journals on both sides. To these journals are fitted links, which connect with the engine beams. The connecting rods between the engine beams and crank-shaft are of steel and rectangular in shape. The crank-shaft is made from one solid forging, with cranks cut out, and the three cranks set at equal angles of 120°. The crank-shaft is 7 ins. in diameter and 9 ft. 10 ins. long, and the crank pins are 7 ins. in diameter and 5 ins. long.

There are three cast iron engine frames, one for each cylinder, all firmly tied together at the bottom by the bedplate, and at the top by bolts between the center or high-pressure cylinder frame and the side, or low-pressure, cylinder frames. It will be seen that the side, or low-pressure, cylinder frames straddle the engine beams and cranks, and carry bearings for the beam shafts and crank-shaft, while the middle frame carries engine-beam bearings, but no crank-shaft bearings. Both the engine-beam and crank-shaft bearings are adjustable and babbitted. The flywheels, two in number, are 8 ft. in diameter and keyed to the crank-shaft outside of the bearings.



View of Water End, Showing Valve Boxes.



View of Steam End of Engine.

FIG. 2. COMPOUND HIGH DUTY PUMPING ENGINE RUNNING 52 HYDRAULIC ELEVATORS AT CUPPLES' STATION, ST. LOUIS, MO.
Laidlaw-Dunn-Gordon Co,, Cincinnati, O., Builders.

A speed governor prevents the engine from running faster than 80 revolutions. By means of a by-pass, it is possible to admit steam for the low-pressure cylinders direct into the receiver without sending it through the high-pressure cylinder. The by-pass valve is operated from a check valve on the discharge pipe, and in such a manner that it will be open when the pump is at rest or the check valve closed, and will be shut when the check valve is open or the pumps in operation. That is, the valve works automatically with the pump. It will be seen that this arrangement enables the engine to start from any position at which it may stop, thereby making the engine automatic in its working and dependent only upon such apparatus as may be used for keeping a steady supply of water at a steady pressure.

The pump end of the engine consists of three single-acting plunger pumps with plungers 4 5-16 ins. diameter and 24 ins. stroke, and connected with the steam end by crossheads connecting the plungers and piston rods. The plungers are of solid steel, and are turned down to 2¾ ins. in diameter at one end to fit the engine crossheads. The pump barrels are made of brass, and are provided with openings and grooved flanges for suction and discharge-valve chambers. Each pump barrel has one discharge-valve chamber and one suction-valve chamber, and each chamber has seven valves 2½ ins. in diameter, giving altogether an effective valve area of 200%. The main suction and discharge pipes are each 6 ins. in diameter, and the discharge pipe has a 6-in. check valve, as before noted. The pump barrels, valve chambers and discharge piping are all guaranteed to withstand a hydrostatic pressure of 2,000 lbs. per sq. in.

In tests made at the shops of the Laidlaw-Dunn-Gordon Co., this pumping engine showed a capacity of 358 gallons per minute at a speed of 80 revolutions per minute. It also showed its ability to work against 750 lbs. water pressure with a steam pressure of 125 lbs. Working with these pressures the engine showed by tests an economy of 24.7 lbs. of water per horsepower per hour at a speed of 60 revolutions per minute. Up to the present time tests of the engine in actual service are not available.

For the matter from which our illustration and this description have been prepared we are indebted to the Laidlaw-Dunn-Gordon Co., Cincinnati, O., and Eames & Young, Architects, Cupples' Station, St. Louis, Mo.

UNIFORM SYMBOLS FOR ENGINEERING FORMULAS.

At the meeting of the Society for Promotion of Engineering Education, held in Springfield, Mass., in September last a committee was appointed to recommend a system of standard symbols to be used in engineering literature, with a view to putting an end to the great diversity in symbols which now prevails. The committee consists of Prof. Ira O. Baker, of the University of Illinois, Champaign, Ill., Chairman; Prof. J. B. Johnson, of Washington University, St. Louis, Mo.; Prof. J. Galbraith, of the School of Practical Science, Toronto, Canada; Prof. F. R. Fava, of the Columbian University, Washington, D. C., and Mr. William Kent, Associate Editor of Engineering News, New York. A preliminary vote of the members of the committee has already been taken by letter upon the following three questions: 1. Shall Greek symbols be eliminated? 2. Shall the significance of a symbol be restricted? 3. Shall Rankine's notation be followed as a basis? The replies may be summarized as a qualified "Yes" to each of the three questions, the qualification being practically expressed in the words "as far as possible." The work of the committee has now been divided among the several members as follows: Mathematics, Professor Fava; Theoretical and Applied Mechanics, Professor Galbraith; Civil Engineering, Professor Johnson; Mechanical Engineering, Mr. Kent. An addition will probably be made to the committee of a specialist in electrical matters, who will report on the symbols used in electrical engineering.

A circular-letter issued by the Chairman states that it is desirable that the members of the committee appointed to report on a particular class of symbols should consult, or associate with themselves, members of the Society or other specialists. Mr. Kent requests that any one interested in the matter having suggestions to make concerning the symbols which should be used in the formulas of mechanical engineering will communicate with him, and no doubt the other members of the committee will likewise be glad to receive suggestions in the line of their specialties.

COMPARATIVE TESTS OF STEAM BOILERS WITH DIFFERENT KINDS OF COAL.*

By Chas. E. Emery, M. Am. Soc. C. E.

The paper of Mr. Dean (presented at the Detroit meeting, entitled "Efficiency of Boilers: A Criticism of the Society's Standard Code of Reporting Boiler Trials") criticises the standard code of 1886 from the fact that it provides to compare the efficiency of boilers by the actual evaporation per unit of combustible. The paper claims that "combustible, as well as coal, varies in heat value per pound;" and urges that boiler trials should be reported on the "basis of efficiency," which is defined to be "the ratio between the total heat which any given coal can generate by complete combustion, and that part of it which is absorbed by the water, and steam heated and generated." He adds: "There are two methods of obtaining the heat value of coal; one by burning a representative sample in some kind of oxygen calorimeter, and the other is to analyze the coal, and equate the elements with their heat values.

It would be strange, indeed, if there were not omissions in the original "Report on a Standard Method of Steam-Boiler Trials." Specifications of ordinary machines and structures are improved every year to keep up with the progress of thought and experience. On the same principle, additions may be desirable to the code of rules for testing boilers, but it is not at all evident that they will be in the direction indicated above. Conclusions drawn by reason from accepted elementary facts are not always correct, because the combinations, so easily made mentally, involve actually many unknown physical conditions. Many such conclusions are so evident that they are suggested again and again. For instance, nothing is apparently more reasonable than the recommendation in Mr. Dean's paper "to analyze the coal and equate the elements with their heat values," but it was known over 50 years ago that this method did not give the practical value of fuel for the purposes of generating steam.

Mr. Emery's paper then discusses at considerable length the results of numerous researches into the evaporative power of coals, including boiler tests, chemical analyses and determinations of heat value by calorimeter. He concludes as follows:

It is a maxim in making tests of all kinds to arrange all the conditions alike, except the particular one to be examined. In applying this principle to the matter in hand, it becomes evident, in view of the varying results obtained with coals of similar composition, that if the comparative evaporative efficiencies of different boilers are to be tested with superlative accuracy, it should be with the same variety of coal burned in furnaces of like construction under standard conditions. The value of improvements in furnaces should not only be tried with the same coal, but with the same, or exactly similar, boilers. Tests of the efficiency of different coals offer more difficulty, as furnaces of a particular form and boilers of particular proportions are not strictly adapted for obtaining the best results from all varieties. It would seem, therefore, necessary in comparing different coals to make changes of detail suited to each, but the same rate of evaporation per square foot of heating surface should be maintained. If other than ordinary details of boilers of unusual proportions are used, the experiments made with the same would not be strictly comparable with tests made of the same coal with different details, or in boilers of different proportions, and this of itself is sufficient to prevent in general any accurate comparison of boiler tests made with different kinds of coal in different parts of the country.

The difficulties in comparing the results of tests with steam boilers are very much reduced if such tests are made with the better grades of anthracite or semi-bituminous coals ordinarily sold in the market, as the difference in results between the same is, as shown by the elaborate Isherwood experiments, very small. As clearly pointed out, the practical evaporations are not accurately proportioned to the calorific values shown by calorimeter or chemical composition, but they can be compared with a fair degree of accuracy by stating the results in units of evaporation per pound of combustible. It does not appear, everything considered, that for tests of different boilers, with different coals of the same general character, any other plan will give results any more accurate. There will be some variations in particular samples of the different coals, even of the better grades, which will affect the results for comparison with other boilers tested with different samples; but these minor differences can only be eliminated by the adoption of the suggestion that in all standard tests of boilers, where great accuracy is required, a particular kind of fuel be employed, which, from the experience of engineers in general, is quite uniform in quality, as regularly delivered in the market. A modification of this would be to compare the boilers in a given location by their relative performance with a fair sample of a particular fuel available in that particular locality, when a careful comparison of the standard fuel adopted in one section with that employed in another would enable the performances of all boilers in different sections to be compared.

* Extract from a paper presented at the New York meeting of the American Society of Mechanical Engineers.

CHICAGO MAIN DRAINAGE CHANNEL. XXII.

(With Inset.)

In our issue of Nov. 21 the construction of the sluice gates and masonry for the regulating works was described, and on our inset sheet this week the machinery for operating these gates is illustrated in some detail.

Machinery for Operating Sluice Gates.—The general arrangement of the sluice gates between the piers and the mechanism for raising and lowering them are shown in Fig. 97. Extending across the top of each pier tower is a fixed steel shaft, 7½ ins. in diameter, keyed to bearings located as shown by the drawings. Turning freely on this shaft at each end, outside of the bearings, is a pocketed chain-wheel, over which traverses a chain, one end of which is fastened to the gate and the other end to the counterweight. The fixed shaft thus carries the weight of the gate and the counterbalance. The chain-wheel revolves on the fixed shaft, and to its hub is keyed a spur wheel (Fig. 98). It is evident that by causing this spur wheel, and therefore the chain-wheel, to revolve, the gate is raised or lowered, according to the direction of the revolution. This revolution is brought about as follows:

Spanning the space between the piers is a 4-in. steel shaft having a pinion and ratchet wheel at each end. The pinion meshes with the spur wheel on the fixed shaft. By means of a ratchet operated by a hand lever, the ratchet wheel, the 4-in. shaft and the pinion are made to revolve, and consequently the spur and chain wheels. To raise a gate, therefore, a man is placed at the hand lever operating the ratchet at each end of the 4-in. shaft, and by working the levers up and down, like a pump handle, the gates are raised. In raising, the power is applied to the down stroke of the lever, and it will be seen from Fig. 98 that the arrangement of the pawls and ratchet are such that a simple reversal keeps the power on the down stroke in lowering the gates.

Taking the construction up in detail, the first feature of note is the expansion coupling shown in Fig. 97. This coupling is designed to adjust to a change of temperature of 150° F. It will be seen that one shaft end is fixed in the coupling box by a taper key, while the other shaft end is secured from rotating by two parallel keys fixed tight in opposite side of the shaft end, but easily in key-ways cut in the box. All journals and shaft bearings, and, in fact, all friction surfaces, are lined with brass or bronze bushings. The spurs, pinions, ratchet and chain wheels are of cast iron, and are so designed that the operating lever will break before the gear teeth will break. Cast iron for gearing is required by the specifications to have an ultimate tensile strength of 30,000 lbs. per sq. in.

The chain is a special pitch crane chain made to fit the pockets of the chain wheel. It is a 1½-in. chain, and, according to specifications, is required to have a breaking strength of 133,000 lbs. and to stand a proof load of 66,500 lbs. without distorting the links.

In a preceding paragraph mention was made of the anti-friction device at the ends of each gate. To each end of the gate there is fastened a cast steel bearing, having a U-section, as shown by Fig. 99. The ends, X, Y, of this U-section bear against

the steel-bearing plate Z, fastened to the shoulder of the pier, with a force equal to the pressure of the water against the upper face of the gate, and of course some method of doing away with the friction of this bearing in raising the gate was necessary. To this end the roller train, A, and wedge bar, B, shown by the drawings, were inserted in the jaws of the U-shaped end bearing, as shown in the plan of the end bearing. The wedge bar has a plain face bearing against the rollers of the roller train and a notched, or pocketed, face bearing against a correspondingly-notched, or pocketed, tongue, C, fastened to the U-shaped bearing casting. Turning to the enlarged drawing of part of the wedge bar and roller train, it will be seen that the wedge bar is first inserted so that the wedge surfaces, or notches, on the bar, B, and tongue, C, mesh with each other. There is then a little more than enough space left to insert the roller train, A. Referring still to Fig. 99, it will be seen that if the wedge bar is raised in the direction of the arrow, the wedge surfaces, or notches, on the bar and tongue will cause the face adjacent to the roller train to press against the rollers and shove them in turn against the roller bearing, Z. Evidently, if the bar be raised enough, the rollers will be pushed against the bearing hard enough to push the U-shaped steel bearing casting away from the bearing plate. This being done, the gate is raised and lowered on rollers, and the only friction is the journal and rolling friction of the roller train.

Normally the gates will bear against the roller bedplate as just described—i. e., through the medium of the roller train—but when it is desired to take out the anti-friction rollers and wedge, the wedge is simply forced back in a direction opposite that shown by the arrow, taking the pressure from the roller train and transferring it to the edges X Y of the U-shaped bearing casting. By means of a crane traveling along the bridge between the tops of the towers, the roller train first, and then the wedge bar, are withdrawn.

It will be noticed that the wedge surfaces of the wedge bar and wedge tongue are concave and convex, respectively. By this construction any small deflection in the gate is taken up without tendency to distort the bearing. To aid further in this adjustment, the wedge tongue is made of Tobin bronze, whose ductility is such that a distortion or flow of metal will take place in the tongue before damage is done elsewhere. Of course, it will be understood that the gates are not calculated to deflect enough to require any such distortion of the tongue, nor even to require much adjusting of the concave and convex wedge surfaces. The wedge tongue is constructed of mild steel, and both the plane surface bearing on the rollers and the wedge surfaces are accurately milled. The Tobin bronze was required by the specifications to be hot rolled, to have an ultimate tensile strength of 70,000 lbs. per sq. in., a minimum elastic limit one-half the ultimate strength, and a minimum elongation of 15%.

The roller bedplate is $1\frac{1}{2} \times 20$ ins., with a universal milled roller bearing face. All the rollers are made of pin steel, with brass bushings reamed to exact size and turn on concentric steel pins, with a clearance of 1-64 in. to 1-50 in. The cast steel bearing bolted to the edge of the gate is cast in two parts, which are bolted together at the middle line of the gate. Other details of the bearing casting and anti-friction device are pretty clearly shown by the illustrations.

Bear Trap Dam.—Besides the sluice gates for controlling the discharge of water from the main channel, there will be a bear trap dam. The principle of this device is so well known that here attention will be confined wholly to the general design and construction of this particular structure. Details of the dam cannot be given at this time, since in calling for bids the engineers of the Sanitary District gave only the general design, leaving all details to be worked out by the bidder in conformity to certain requirements. The general form and dimensions of the dam are shown by the sketch diagram, Fig. 100. It consists of a downstream leaf, A, hinged at a, and an upstream leaf B, hinged to the downstream leaf at b, and both leaves work up and down between two abutments, C and D, 160 ft. apart. The leaves A and B are to be steel or iron girders of sufficient strength to withstand all forces without undue stress. The crest, d e, is raised or lowered, by admitting or excluding the water from under the dam, but no details of this control of the water are available. To properly balance the weight of the leaves and the available pressure of the water under the dam, the counterweight, F, is provided. The friction roller c runs on a track fastened to the abutment masonry.

The general form and operation of the dam being thus made plain, attention may be turned to the specified requirements for its design. It is required that the maximum weight of the upstream leaf shall not exceed 335,000 lbs. and of the downstream leaf, 520,000 lbs. The friction of the friction roller is limited to an amount not exceeding 10% of the load carried by it, and the coefficient

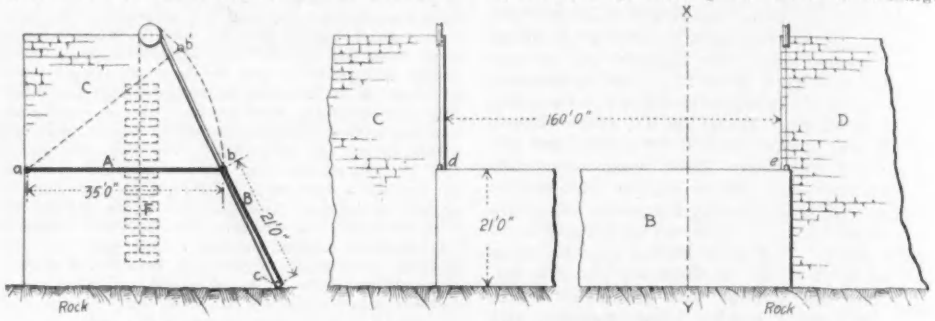


FIG. 100. DIAGRAM SHOWING OPERATION OF BEAR TRAP DAM.

of friction of the downstream hinge (a, Fig. 98) is limited to not over 15%. All stresses are to be within the limits of safety determined by good practice. The details are required to be such that no leakage of water underneath the dam shall occur.

It will be seen that the principal difficulties in the design are (1) to make the upstream leaf strong against lateral deflection, due to the water pressure; (2) to secure as nearly as possible a uniform frictional resistance—in hinges and rollers—throughout the entire length of the dam, in order to prevent tilting or one end rising faster than the other, and (3) to devise some form of counterweight whose operation will prevent tilting or one end rising faster than the other. These are all problems due to the great length of the dam. The form of construction adopted to secure these requirements has not been determined in detail and cannot be given here. In respect to the construction of the counterweights so as to adjust the differences of friction, the idea of the engineers of the Sanitary District is to have them made up of a series of disks or plates, suspended one above the other with a space of about an inch between them, and, as the dam rises and the counterweight descends, to have these disks come to rest one after the other. By this construction it will be seen that if one end of the dam rises faster than the other, the disks on the counterweight at that end will come to rest faster than those at the other—that is, the pull will be decreased at the fast-rising end and not decreased at the slower-rising end, and the dam will thus tend to come to a level.

In closing this brief description, it may be noted that this will be the largest single length of bear trap in the world.

Miscellaneous Constructions.

Up to this time the description of the drainage channel has been confined to the construction of the main and river diversion channels and the works forming integral parts of those channels. There are, however, various supplementary constructions not forming part of the main channel, but yet essential to its final usefulness, which must yet be constructed. These constructions comprise: (1) Tail-race and channel to carry water through the city of Joliet, Ill.; (2) supply channel to furnish the main channel with water from Lake Michigan, and (3) bridges to carry the various highways and railways across the main channel. No final plans have yet been adopted for these works, and only a general statement of conditions can be made.

Tail-Race.—The tail-race into which the water will be discharged from the regulating works is nothing more than its name implies—a channel which will convey the waste water into the Desplaines River. Supplementary to the tail-race channel will be the deepening and widening of the river down through the city of Joliet, Ill., so that it can take care of the water discharged from the main channel without danger of flooding the city. Altogether the tail-race channel and other improvements will cost about $2,335,000.

A possible feature of this tail-race work which has not received the official cognizance of the Board of Trustees, but which has attracted considerable study from the engineers and individual members of the Board, is the possibility of developing a very large water power from the discharge of the main channel. The available power will be divided into two reaches of about four miles each, each having a natural fall of 35 ft. The first fall will be between Lockport and upper Joliet, and the second between upper Joliet and Lake Joliet. With a flow of 5,000 cu. ft. per second, about 20,000 HP. can be developed at each fall, or altogether 80,000 HP., when the full flow of 10,000 cu. ft. per second is sent through the canal. This is, of course, the gross horse-power available. The net horse-power will be considerably less, but yet of sufficient magnitude to rank among the greatest water powers of the world. The possibilities of this power with the development of electric transmission will be readily appreciated.

Supply Channel.—The main drainage channel when flowing full has a capacity of 600,000 cu. ft. per minute, while the Chicago River, with which it connects, will furnish only about 150,000 cu. ft. per minute under present conditions. To supply the main channel with water, therefore, will require ultimately the construction of a supply channel. When the drainage channel is first opened, however, and indeed for some years afterwards, it will discharge only 300,000 cu. ft. per minute, and the engineers of the Sanitary District consider it to be entirely practicable to deepen and widen the Chicago River enough to furnish this amount without detriment to the river navigation. The improvement to the river suggested by the engineers is to dredge the river to a depth of 20 ft. at mid-channel and 12 ft. at the dock lines, and to replace some of the present bridges with structures of greater span; or where this is not possible, to construct by-passes around them. It is estimated that the cost of this work would be about as follows:

Dredging	$250,000
Constructing by-passes	450,000
Changing bridges	85,000
Dock changes	87,500
Total	$872,500

As soon as the full flow of 600,000 cu. ft. per minute is required, some additional channel will be required. Just what form this channel will take has not been decided upon, although several plans have been suggested and briefly considered. These plans have generally provided for one of two things—either taking their water from the Calumet River through a channel along the old Sag feeder to the Illinois & Michigan Canal, or else cutting a canal or tunnel through Chicago to Lake Michigan.

The chief objection to the Calumet River chan-

nel is that it would aid in no way toward purifying the Chicago River. At the same time if the city of Chicago continues building sewers to discharge into the Calumet River, the time will come when its purification will be demanded. This is a problem which can wait solution for many years, however, while the purification of the Chicago River is of immediate importance.

In respect to the channel through the city of Chicago, either the North or South Branch of the Chicago River will probably be connected with the lake. Just which route is preferable cannot be known until the careful surveys now in progress have been worked up. From the fact that the present elevation and grade of the main channel will not purify the South Fork of the South Branch—one of the foulest parts of the river, since it takes the sewage of the stock-yard district—it would seem advisable, other things being equal, to have the channel connect with the South Fork. It is probable, however, that a channel connecting with the North Branch would be the cheaper, owing to the less improved territory through which it would pass. It is entirely probable also that the best solution of the problem will be to connect both the North and South branches with the lake. Another plan which has been talked of is to extend the North Branch to the lake at a point north of Evanston, the topography of the country being very favorable for such a channel.

All of these are suggested plans only, and until the complete surveys are worked up it is impossible to say which is the best, all things considered.

Sewerage System of Chicago.—At present the sewers of Chicago empty into the Chicago River, Lake Michigan and the Calumet River. After the drainage channel is built, there therefore remains the problem of getting a very considerable portion of the city's sewage into it. Strange as the fact may seem, the officials of Chicago do not seem to have given any thought to this question until 1895, several of the large trunk sewers planned in the two preceding years being designed to empty into the lake directly. In 1895, however, these plans were changed, and plans were also prepared for intercepting sewers to catch the sewage now entering the lake and take it to the Chicago River. Like the supply channel problem, the definite plans for the sewerage system of Chicago yet remain to be determined.

Bridges.—The bridging of the drainage channel promises some interesting problems. There will be five railway crossings and at least as many—probably more—highway crossings, all of which must be bridged. On the earth sections the clear span which will be required will be 202 ft. and on the rock sections 160 ft. With one exception, the railway bridges will be single track structures, and neither these single-track railway bridges nor the highway bridges will offer any very great difficulties from a structural point of view. The single bridge which will carry more than one track is the crossing of the six tracks entering the stock-yards. This is a skew crossing.

Although there has been much discussion by the Trustees, the exact character of the bridges to be built has not been permanently settled. It was at first decided to build swing bridges throughout, but after plans and specifications had been prepared for three swing bridges and bids received, the Trustees reversed their first decision and determined to build temporary structures only at present. A radical difference of opinion on the advisability of such action at once arose among the Trustees, and although the majority action still stands in favor of temporary fixed bridges, the question is likely to come up for reconsideration before anything is done toward actual construction.

Thus far a definite agreement for a bridge across the main channel has been made with one railway company only, the Pittsburg, Ft. Wayne & Chicago Ry. Co., which controls the six-track crossing to the stock-yards. This agreement provides that during excavation of the channel at this point a temporary trestle structure shall be built; but that within two years this shall be replaced by a permanent steel bridge of either fixed or swing span, as the Sanitary District may choose. As will be seen, this agreement leaves the way open for either a fixed or swing span solution of the bridge problem.

(The End.)

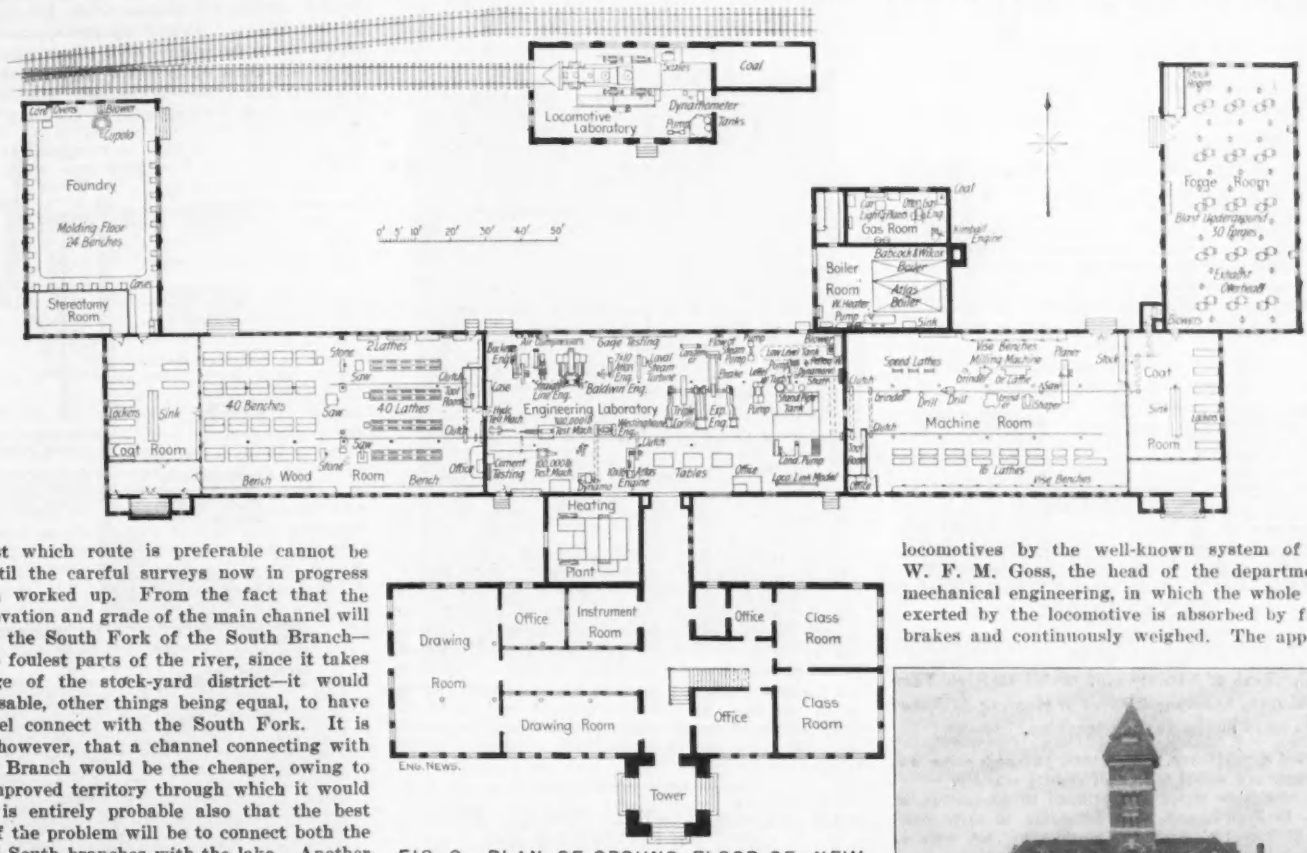


FIG. 2. PLAN OF GROUND FLOOR OF NEW ENGINEERING BUILDING AT PURDUE UNITERSITY.

THE NEW ENGINEERING BUILDING OF PURDUE UNIVERSITY.

The engineering building of Purdue University, Lafayette, Ind., which was destroyed by fire on Jan. 23, 1894, has now been replaced by a much finer structure, which was dedicated on Dec. 4, 1895. We present herewith a drawing showing the plan of the first floor of the buildings, containing the mechanical laboratories and workshops, and also a photograph of the exterior.

Purdue University was organized under the U. S. "Land Grant" act of July 2, 1862, for aiding state colleges which should teach branches of learning related to the agriculture and the mechanic arts. The provisions of the act were accepted by the state of Indiana in 1865, which also accepted donations from Mr. John Purdue and other citizens amounting to $265,000. The institution is entirely under state control. It embraces six special schools—viz., those of mechanical engineering, civil engineering, electrical engineering, agriculture, science and pharmacy. It now owns 180 acres of land and 18 buildings, valued in all at about $550,000. It has a permanent endowment fund of $340,000, and an annuity of $20,000 from the U. S. Government. An annex to the mechanical laboratory contains a laboratory for testing locomotives by the well-known system of Prof. W. F. M. Goss, the head of the department of mechanical engineering, in which the whole power exerted by the locomotive is absorbed by friction brakes and continuously weighed. The apparatus is arranged so that the locomotive belonging to the university may be run out of the laboratory, so that any other may take its place. It is to be expected that much valuable information will be obtained by this method of testing.

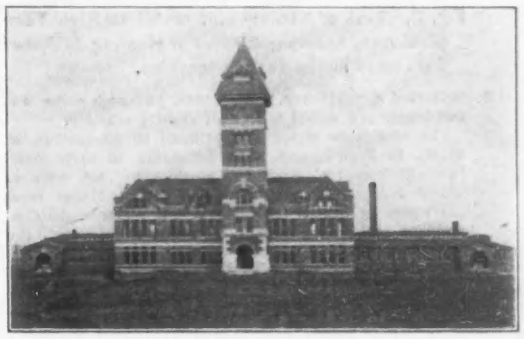


Fig. 1. New Engineering Building of Purdue University, replacing one destroyed by fire in 1894.

EFFECT OF TEMPERATURE ON STRENGTH OF WROUGHT IRON AND STEEL.*

By R. C. Carpenter, Ithaca, N. Y.**

The investigation described below was conducted in the spring of 1895, in the testing laboratory of Sibley College. The tests were performed on a horizontal Emery testing machine, having a maximum capacity of 200,000 lbs. The method employed in making the tests differed from that employed in ordinary testing only in the provision for heating the test piece to a specified temperature and maintaining it at that point throughout the test.

A solid block of cast iron made in two halves and held in position by clamps, as shown in lower part of Fig. 1, surrounded the test-piece. This block was heated externally, and transmitted its heat to the test-piece. The temperature was measured by a mercurial thermometer, the upper part of which was filled with nitrogen to prevent vaporization of the mercury at high temperatures; it was graduated to 900° F. The

* Abstract of a paper presented at the New York meeting of the American Society of Mechanical Engineers.

** Professor of Experimental Engineering, Sibley School, Cornell University.

bulb of the thermometer was put in direct contact with the test specimen, and was partly surrounded by the solid metal of the cast iron jacket. The length of the jacket was about 2 ins. greater than the gaged length of the test specimen. The iron jacket, when in position on the test specimen, was heated by a Bunsen burner having four jets, the apparatus being as represented in Fig. 2, in which T is the thermometer,

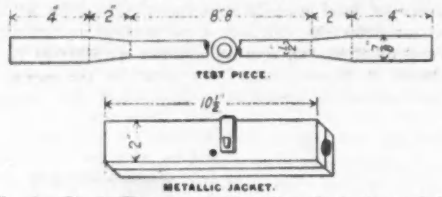


Fig. 1. Test Piece and Metallic Jacket used in Determining Strength of Bars at High Temperatures.

a a the ends of the test-pieces, J J the cast iron jacket, B the burners, and H H the pulling heads of the testing machine.

This method of heating the test-piece proved very satisfactory, and gave very uniform results. There may have been some error in the measurement of temperature, due to the fact that the thermometer was not entirely surrounded by the metal, but no readings were taken until several minutes after the thermometer

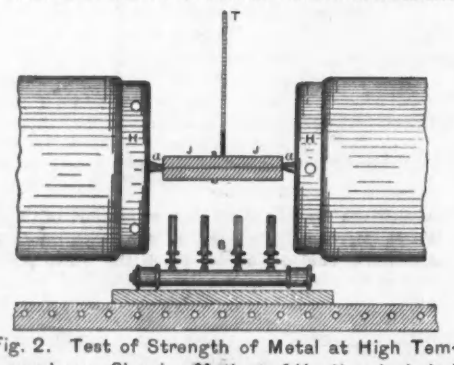


Fig. 2. Test of Strength of Metal at High Temperatures, Showing Method of Heating Jacketed Bars while in the Testing Machine.

indicated a stationary temperature, and such error was not large, and would not affect results sensibly.

The specimens tested were turned to dimensions, as shown in Fig. 1, and those belonging to each class, wrought iron, tool steel, and machinery steel, were as nearly uniform in quality as could be obtained from the stock in Sibley College. About 30 specimens of wrought iron were tested and about 25 of steel, the

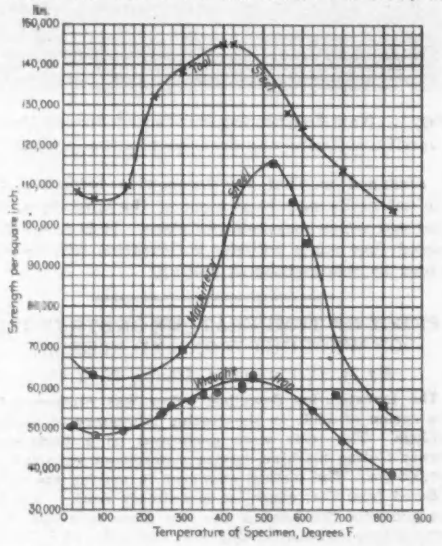


Fig. 3. Diagram Showing the Ductility of Wrought Iron and of Tool Steel at Temperatures to 825°F.

temperatures varying in each test from 22° to 825° F., the lowest temperature being obtained by use of a freezing mixture, the highest temperature as explained. The method of heating the specimen prevented the use of appliances for measuring extension while under stress, so that information could not be obtained regarding the elastic limit or modulus of elasticity.

Results.—The general results of the test are shown on the curves accompanying the report, from which it will be noted that all the curves have a point of contra-flexure at about 70° F., and another at a temperature not far from 500°. The maximum strength is found at temperatures of 400° to 550°. At temperatures higher than this, all the materials show a rapidly decreasing strength. The variation in strength with change of temperature is marked; thus, for instance, with wrought iron, if we represent the strength at temperature of 75° as 100, that at from 22° to 25° is 103 to 104, at 500° is 126, while at 825° it would be represented by 80.7, which is 63% of the maximum strength; beyond this point the strength steadily decreases.

The curve for tool steel has the same general form,

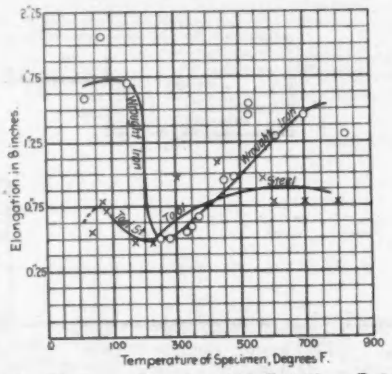


Fig. 4 Diagram Showing the Relation Between Tensile Strength and Temperature of Iron and Steel up to 825°F.

the temperature of maximum strength being, however, about 400°. That for machinery steel is similar, but no experiments were made at low temperatures and no critical point was observed.

The elongation in 8 ins. of length for the tool steel and wrought iron is shown on the curves in Fig. 4, from which it is noted that these curves are of the same general form, and agree in showing smallest elongation when at a temperature about equal to the boiling point of water. There is considerable variation in the results given by individual specimens, especially for the tool steel; and there is, for this reason, doubt as to the exact position and form of the curve. A large portion of the discrepancy is no doubt due to the methods which had to be employed in measuring the elongation.

THE EXPERIMENTAL WATER FILTER TANK AT PITTSBURG, PA.

The combination of cement or concrete with metal is becoming more and more common where lightness and strength are desired. In our issue of Feb. 22, 1894, we illustrated and described a covered reservoir at Rockford, Ill., the roof of which was formed of concrete and expanded metal lath; and in our issue of Dec. 7, 1889, the possibilities of this metal for use in fireproof construction were discussed. We illustrate herewith a small experimental water filtration tank at Pittsburg, Pa.

A circular tank of about 1,500 gallons' capacity was desired, and arrangements were made with the Central Expanded Metal Co., of Pittsburg, for the construction of a tank of cementine, as the combination of expanded metal lath and cement is called.

A concrete foundation 18 ins. thick, on hardpan, was first built, as shown in the partial section of the tank, Fig. 1. The necessary piping was embedded in the concrete. The tank was to have an inside diameter of 6¾ ft. and a height of 6½ ft. In constructing the metal portion of the tank, bottom sheets of heavy expanded metal, such as is used for fencing, with 7 × 3¾-in. diamond meshes, were placed on the concrete, with joints breaking. Transversely over these, lath metal, a lighter material, was placed with overlapping edges, slightly laced to each other and wired to the studding rods. These rods were of 7-16-in. steel, set 6 ins. into the concrete, 15½ ins. apart, and shouldered into a ¾ × ⅜-in. steel channel ring at the top, as shown in the view, Fig. 2. The metal lathing sheets, which are 20 ins. wide and 8 ft. long, were tied to the studding every 5 ins. with soft No. 16 steel wire. The meshes of the lathing are 7-16 × ¾ ins., and of such shape as to form slight ledges for retaining the cement mortar. The latter was composed of 1 part American Portland cement (Alpha) and 2 parts sharp common river sand. The cement was applied in coats, inside and out, until a total thickness of 2 ins. was obtained. A wooden template was used for a ground, held in place by wiring. No special care was taken to shield the work from the sun during construction, and but little dampening was done during the first few days of setting. After eight or ten days the interior was coated with asphalt and the tank filled with gravel and sand, as shown in Fig. 1.

The unfiltered water is received in the projection at the top, Figs. 1, 2 and 3, and the samples of filtered water are drawn from the bottom projection, Fig. 3. Ranged up and down the outside of the tank, as is somewhat dimly shown in Fig. 3, are six glass observation gages; water may be drawn through these if desired. Fig. 4 is a view of the expanded metal used in the tank wall.

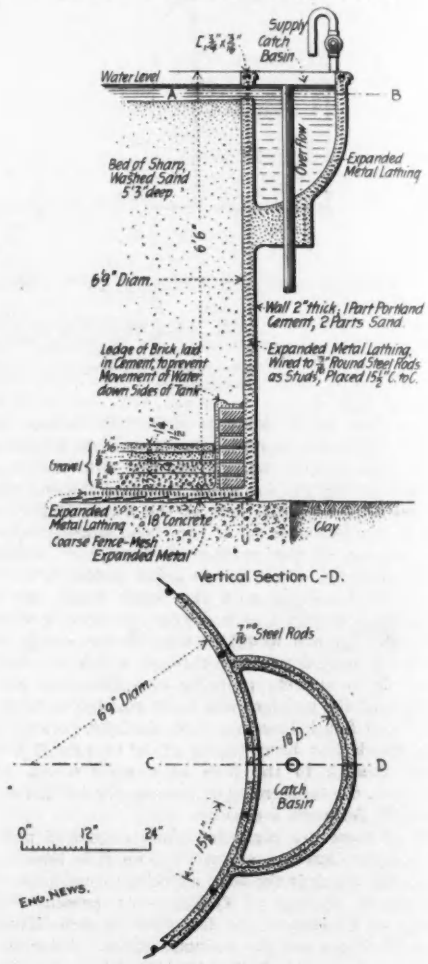


Fig. 1. Partial Sections of Experimental Filter Tank, Pittsburg, Pa.

We are indebted for the above information to Chess Bros., of Pittsburg, Pa., manufacturers of expanded metal, and to Mr. Merrill Watson, Manager of the New York office (107 Chambers St.) of the Central Expanded Metal Co., of Pittsburg, Pa.

Since writing the above, we have received from Mr. Jas. Otis Handy, Chief Chemist of the Pittsburg Testing Laboratory, some interesting additional information regarding these tests, including some of the results thus far obtained. The dates at which the different portions of Mr. Handy's letter were written are indicated below. The letter, with the omission of a part of the description of the plant, fully given above, is as follows:

(Oct. 29.) I have your favor of Oct. 19, requesting information about our experiment in water filtration. I gladly give you the meager statistics which we now have, and I shall be most pleased to communicate to you a little later more interesting facts as to what the capabilities of the filter shall have proved to be.

You are, of course, familiar with the work of the Joint Water Commission of this city during their study of the water question in 1893. (Noticed in Engineering

News, April 12, 1894.—Ed.) They made no experiments, but reached the conclusion from a study of our conditions that filtration was the proper thing. They hoped that the authorities would take up the work and experiment at once, but, on the contrary, their conclusions were violently opposed by the Director of Public Works, who has stoutly maintained that the water was all right, and has attempted to reinforce his statements by producing chemical (not bacteriological) analyses by eminent university professors.

The engineers, physicians and chemists of Pittsburg refused to accept this dictum, and informed the public through the newspapers that, in the face of our shamefully high typhoid fever mortality, the public water supplies of Allegheny and Pittsburg could not be exculpated by chemical tests, however favorable.

Despairing of public assistance, the work of testing the availability of our river sand for the purposes of water filtration has been undertaken by a number of public-spirited persons known as the Citizens' League. They have had the financial help of other public-spirited persons—lawyers, physicians, engineers, chemists and business men have contributed. Work was begun last summer, and we have just finished the construction of a one-story building, 20×14 ft., for the filter and the laboratory. The filter was built first. (See above description.—Ed.) Except for a few small leaks at first, there has been no sign of leakage or evaporation from the outer surfaces of the tank.

The filtering material is common river sand of an effective size of 0.30 mm., or 0.01179 in., and a uniformity coefficient of 2.6.* A depth of 4½ ft. of this is held up on the following arrangement of gravel: On the bottom of the tank, which slopes to the outlet, is a 2-in. layer of ½-in. gravel graded horizontally; on this is a 2-in. layer of ¼-in. gravel, then 1¾ ins. of ⅛-in. gravel, and then 1¼ ins. of coarse sand, and above this the 4½ ft. of filter sand. We made no special selection of sand, but chose the ordinary river sand just as it is furnished for building purposes. It was necessary to wash it thoroughly with water until the washings came off clear. For our purpose we used an inclined mortar box and washed several bushels of sand at once with a strong stream from a small hose. The sand was allowed to drain, and then shoveled into another box to mix it before placing it in the bed. The tank was fitted with gage tubes about 1 ft. apart, for the purpose of indicating loss of head as the filtration proceeded.

Fig. 2. View Showing the Metal Work in Place.

The filter was filled with unfiltered water from below on Sept. 22, 1895. The filling occupied about three hours. The city water was very muddy at the time. Filtration was started very slowly, but in three days the rate was increased to 2,000,000 gallons per acre per day, at which rate it has been maintained, with a few interruptions, until the present time. The rate is now to be 2,500,000 gallons per acre per day. The filtered water has been clear from the start, with the exception of about ten days, when it showed a faint bluish white opalescence. Since then it has been as clear and sparkling as distilled water.

* Effective size = 10% of material finer than this. Uniformity coefficient = size of sand grain at 60% point, divided by that at 10% point, or effective size. Dimensions used are diameters of grains; portions below points named are taken by weight.—Ed.

The bacteriological control tests up to the present date have been made under the difficulties incident to an improvised laboratory. They showed:

Date.	Approx. total amt. filtered from begin'g, galls. per acre.	Per cent. bacteria removed.
Sept. 23	200,000	0
" 25	2,600,000	27
" 26	4,600,000	40
" 27	7,000,000	46
Oct. 4	21,000,000	69
" 8	29,000,000	85
" 12	37,000,000	89

The number of bacteria per cubic centimeter found in the raw water has been from 200 to 1,600 when cultivated three days at 60-70° F. Up to the last date given above, there had been only a loss of 1 in. head by clogging. Since then the loss has increased to about 9 ins.

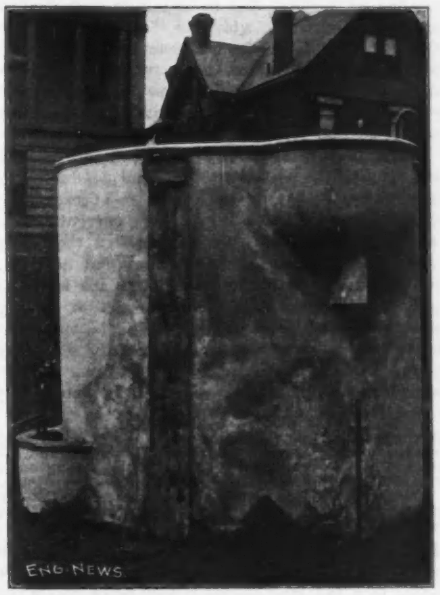


Fig. 3. View of the Completed Tank.

It is believed that the percentages of reduction have gone on increasing regularly, but it has been impossible to make tests with greater refinement than to show that the removal of bacteria exceeds 90%. Exact data as to the state of efficiency of the filter will be available in a short time, as the work will now be carried forward in a suitable laboratory.

The thanks of the League are due to Mr. Allen Hazen, of Boston, for advice concerning the construction of the filter. The staff in charge of the filter at present consists of Dr. Eugene Matson, Bacteriologist; Jas. O. Handy, Chemist and Assistant Bacteriologist.

We shall run the filter for a considerable period as a public demonstration. It has already attracted a great deal of notice, and has been the subject of many newspaper articles. We shall try different rates of filtration, and eventually the intermittent system. At present we are using the continuous system of sand filtration.

(Nov. 2.) I have held this letter in order to give some of the results of this week's tests of the filtered water.

Bacteriological Results.

Date.	Bacteria per cu. cm. Raw.	Filtered.	Reduction, %.
Oct. 28	848 / 858	8.0 / 1.0	99.47
Oct. 29	782	4.5(average)	99.43

It is not yet known what results will be obtained by cultivation at a constant temperature under entirely satisfactory conditions. These last cultures, like the first, developed three days at a temperature of 60 to 70° F.

Chemical Analyses, Oct. 30, 1895.

	(Parts per 100,000 by wt.) Raw.	Filtered.	Reduction, %.
Free ammonia	0.00093	0.00026	72
Albuminoid ammonia	0.00620	0.00180	71

A later communication from Mr. Handy, under date of Nov. 16, gives the following additional information, which is of interest as showing the action of the filter after a number of weeks of use and the effect of scraping off its upper clogged layer of sand. The letter is as follows:

The filter ran practically continuously for seven weeks before the loss of head was sufficient to bring the discharge down to less than 2,500,000 gallons per acre per day, through our ½-in. effluent pipe. From Oct. 12 to Nov. 9 the loss of head averaged about 1 in. per day. From Nov. 9 at 8 a. m. to Nov. 11 at 8 a. m., the loss amounted to 5 ins., an average of 2.5 ins. per day. From Nov. 11 at 8 a. m. to Nov. 11 at 11 p. m., the loss of head was 11 ins. This clogging was apparently quite independent of any extraordinary amount of turbidity in the raw water. On the contrary, the city water was unusually free from sediment, except during the first part of the run, at which time there was no apparent loss of head.

The number of bacteria in the filtered water remained extraordinarily low, averaging only about 4 ins. per cu. cm., and possibly less on account of the difficulties before mentioned.

On Tuesday, Nov. 12, the filter was scraped to a depth averaging about ½ in. The surface of the sand was covered to a depth of about ⅛ in., with fine, brown sediment. Precautions were taken to avoid disturbing the sand underneath. Refilling with raw water from below was accomplished at an average rate of 4 ins. per hour. The raw water was quite muddy, and contained 500 to 600 bacteria per cu. cm. The second run of the filter was started at 8 a. m., Nov. 13. The first tests were made Nov. 13 at 8 p. m. (twelve hours after filling with raw water). The results were surprisingly good. The clogging had been completely removed. The results on a 48-hour count were:

Raw water,	505	bacteria	per	cu.	cm.
Filtered "	13	"	"	"	"
Reduction,	97.4%.				

RATES OF WORKING OF BRITISH NAVAL BOILERS.

In the presidential address of Mr. Albert Durston before the British Institute of Marine Architects he gave some figures concerning the present practice in proportioning boilers in the British Navy and their economical performance. We quote as follows:

For the ordinary boiler the size of boiler fitted is such that 1 HP. is developed for each 2½ sq. ft. of total heating surface on an eight hours' trial, termed the natural draft trial. For a shorter trial of four hours' duration, called the forced draft trial, this power is increased by 20 to 25%. On actual service the minimum which it is insisted must be developed by the engines and boilers continuously for as long as the coal will last in the vessel, is 60% of the natural draft power,

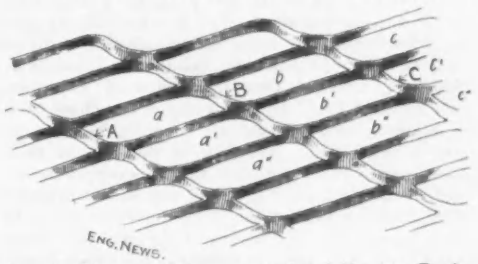


Fig. 4. Sample of Expanded Metal Used in Tank.

so that at this minimum power the heating surface is about 4 sq. ft. per I. HP. This continuous power corresponds to the sea-going powers of the mercantile marine. The table exhibited shows the results of a series of 14 trials, and by inspecting the column showing the heating surface per horse power actually developed, it will be seen that the royal navy and mercantile marine practices on this question are much the same.

Trial at Maximum Continuous Power.

Ship.	Load on safety valve, lbs. per sq. in.	Duration of trial in hours.	I. HP.	Heating surface, sq. ft.	Heating surface, per I.HP., sq. ft.	Coal per I. HP. per hour, lbs.	Full nat. draft power.
[1]Royal Sover'gn.	155	72	8,180	20,034	2.44	1.84	9,000
[1]Royal Arthur.	155	72	8,821	24,828	2.81	1.85	10,000
[1]Sans Pareil	135	50	7,051	19,980	2.83	2.23	7,500
[1]Sirius	155	64	4,555	15,918	3.49	2.03	7,000
[1]Pallas	155	73	3,620	11,100	3.06	....	4,500
[1]Resolution	155	48	8,085	21,178	2.61	2.10	9,000
[2]Cossack	130	48	1,435	6,836	4.76	2.51	2,200
[2]Mohawk	130	48	1,998	6,836	3.42	2.70	2,200
[2]Fearless	120	48	1,888	6,439	3.41	2.46	2,100
[1]Spartan	155	72	6,777	15,918	2.34	1.96	7,000
[1]Bonaventure	155	72	7,083	15,000	2.20	1.76	7,000
[3]Partridge	145	48	719	2,087	2.90	2.10	700
[1]Vulcan	155	48	7,236	15,868	2.19	1.86	7,200
[1]Buzzard	140	48	1,232	3,892	3.10	2.40	1,400

[1] Vertical triple. [2] Horizontal compound. [3] Horizontal triple.

A section of the old track of the Erie R. R., consisting of pear-shaped rails spiked to wooden stringers, as laid 53 years ago, has been unearthed in digging a trench for a water main under the railway tracks at Middletown, N. Y. This type of construction was continued only to Otisville, 8 miles further, beyond which point cross-ties were used. The old track was evidently covered up when a change of grade was made.

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It might be supposed that the long debate which has gone on in Buffalo over the terms of the franchise just granted to the Niagara Power Co., ought to have had some effect in educating its citizens respecting the value of municipal franchises and the possibilities of municipal income from them. We find, however, that the Board of Aldermen has recently voted to give away a franchise to a new street railway company, covering 66 miles of streets, and this in the face of the fact of such sharp competition between the existing company and the new company that had any decent attempt been made to protect the city's interests, there is little doubt that the franchise for the new lines could have been made to return to the city a handsome percentage on the gross receipts, and could have been limited to a short term of years.

In Brooklyn, the absurd system under which valuable public property in the shape of street car franchises are disposed of is well illustrated by a scramble of some of the principal street railway companies to file "locations" upon a lot of unoccupied streets. It is, indeed, a striking example of popular ignorance as to the value of public franchises that the mere filing of a "location" for a railway line upon a particular street should give the first company which does this some sort of claim upon the street. No corporation managed on business principles would dream of treating its sources of revenue in this way. What street car company would consider that the first concern which applied for advertising space in its cars had any superior claims to consideration by virtue of that application? It would very properly say that its cars were its own property and it had a right to admit or exclude advertisements from them, and if it chose the former course it would sell the privilege on the best terms possible. It ought not to be difficult to apply these same principles to the streets owned by a municipal corporation.

The recent terrible accident at Cleveland, O., when an electric car plunged into an open draw and fell nearly 100 ft. into the Cuyahoga River, has brought out the usual crop of inventions and suggestions of safety devices designed to prevent such accidents. The fact seems to have been very generally overlooked that with an electric railway the protection of a drawbridge can be accomplished with wellnight infallible certainty by simply making the unlocking of the swing-span automatically cut off the current from a section of the trolley wire adjacent to the bridge. It has been stated, indeed, that such a device was in use on the structure where this terrible accident occurred, and was removed only two or three weeks previously. If this is correct, the responsibility of the company for the fatal accident is evident.

That a device of this character should be in use at every drawbridge crossed by an electric railway, the Cleveland disaster ought to make evident to every street railway manager. Mr. R. D. Rowe, M. Am. Soc. C. E., writes us from Chicago, that all the drawbridges in that city which are crossed by electric railways are equipped with cut-out devices of this class. He also calls attention to the fact that in installing such devices the section of track which is "dead" when the bridge is open should be long enough to prevent a car from coasting up to the draw opening. It is true that only gross carelessness on the part of the motorman would permit a car to coast over a "dead" section of track into an open draw; for at night the extinguishing of the lamps would instantly apprise both motorman and conductor of the open draw, even if they were so obtuse as to fail to notice the stoppage of the current otherwise; and it is hardly to be supposed that they would coast into an open draw in broad daylight. But, as Mr. Rowe well points out in his letter to us, no chances of careless motormen or failing brakes should be taken; and it should be made impossible for a car to reach an open draw either by its own motive power or its momentum. A further advantage of this arrangement is pointed out by Mr. Rowe as follows:

> If anything gets out of order about the only working parts (the contact devices), the power is cut off and the matter must be remedied and the whole arrangement put in working order before cars can cross the bridge. In other words, it exemplifies an axiom in railway signaling in that "it goes to danger when anything breaks."

It may be pointed out further that with such an arrangement in use the antiquated system of coming to a full stop at every such point and waiting for the conductor to go ahead and signal all clear, or close a derailing switch, might with entire safety be abolished, with a considerable gain to the operating schedule.

Criticism of our consular service and an unfavorable comparison of the work performed by American consuls, when contrasted with that of the representatives of other governments, are common just now in the public press, and Congress is being called upon to devise plans of reorganization and reform. As far as these comparisons affect the British consular system, the highest commercial authority in England, the British Association of Chambers of Commerce, has recently officially commended the American system of consular reports, and advised English consuls to model their reports upon them as tending to give more valuable information to the business community. English consuls are appointed to office upon very much the same system that prevails in the United States, with the exception that the average tenure of office is usually longer with the English consul, and he has thus a better opportunity to acquire the experience and training necessary for the proper performance of his duties. Under the present system of consular reports required by the government of the United States, much useful information pertaining to business prospects in foreign parts is undoubtedly placed at the disposal of the manufacturers and merchants of this country. But, as a rule, the consuls who write these reports, although well-meaning and often intelligent men, are absolutely without any previous training or special equipment for the study of commercial and industrial matters. In certain lines, at least, these reports would be much more valuable were our consuls longer in office and more familiar with their field of duty and the commercial needs and resources of the region in which they are stationed. While our system may compare very favorably with that of England, there is evidence that the systems of Belgium, France, Germany and Switzerland are superior to either. In those countries consular agents are specially trained and fitted for service abroad; they speak many languages, are familiar with international law and the trade resources and requirements of all countries; they are practically permanent in the service and as their usefulness increases by length of actual service, they are transferred to higher positions. It is not to be expected that the United States can at once so radically change the methods of its consular appointments as to equal these Europeans in special efficiency and previous equipment. But we can improve our service by leaving a good consul in his place sufficiently long to acquire the necessary experience, and then promote him to a more important post as the opportunity offers. This means consular civil service; but it would be infinitely better than the prevailing system of replacing a man who has gained valuable experience, at four-years' intervals, by another man, who must freshly acquire the same experience before he becomes even equally useful.

The proper monumenting of public land surveys is especially important in the far Western states where irrigation, mining and other industrial enterprises are based upon and must be connected with and are governed by such surveys. In this connection, Mr. Elwood Mead, State Engineer of Wyoming, is making a vigorous effort to bring about the legislation necessary for authorizing and providing means for the better and more frequent identification of corners and bench marks as established by the public surveys. In this effort Mr. Mead has the direct support of Mr. Chas. W. Walcott, the present Director of the U. S. Geological Survey, and that of the State Engineers of Idaho and Colorado and other engineers of experience in the region affected. The urgent necessity for this work is apparent; for, as Mr. Mead says in a letter to Director Walcott, the utility and practical value of any survey depends largely upon the measure taken to preserve its results and to enable them to be identified upon the ground and put to use in more detailed local surveys, which must be based upon them. In the absence of definite and permanent landmarks, the maps themselves are practically useless, for the identification of corners and levels must be absolute to be of any value. The contours on these public maps are not located with the sufficient accuracy of detail required in mining, water supply or irrigation development; and while monuments need not be so numerous as to unduly increase the cost of the surveys, they should be sufficiently close together to provide the absolute data needed in local surveys. Then, too, as the maps of the Geological Survey are issued upon a different scale from the public land surveys, the sections and townships of the latter not being marked on the Geological maps, there are no means of using the monuments of the one to identify and locate the contours of the other, even where these contours are accurate.

Mr. Mead recommends the placing of permanent iron or stone monuments at each township corner, and submits a design for a cast-iron monument in his letter to Director Walcott. This is a hollow iron post, 4 to 4½ ft. long, 6 ins. square, ¼ in. thick and surmounted by a truncated pyramid serving as a bench mark. One side of this monument would bear the initials of the U. S. Geological Survey, and on the other side would be a groove into which cast iron figures could be slipped and secured by a screw, indicating the established elevation of the top of the monument. The whole monument would weigh about 85 lbs. The position and elevation of these monuments should, of course, be marked upon topographic maps, so that each may be easily identified. Iron is suggested as preferable to, and more durable than, monuments made of the sandstone of this region, and Mr. Mead points out that many of the landmarks now used in the public surveys are made of material subject to rapid decay, or they are so insecurely established as to be liable to disappear from other causes within a short period of years. In this connection it might be remarked that, in this section, at least, a 4-ft. iron post 6 ins. square, having as much of its length projecting out of the ground as is buried beneath it, would hardly be regarded as safe against disturbance, by frost or other causes. But as Mr. Mead should better know the requirements

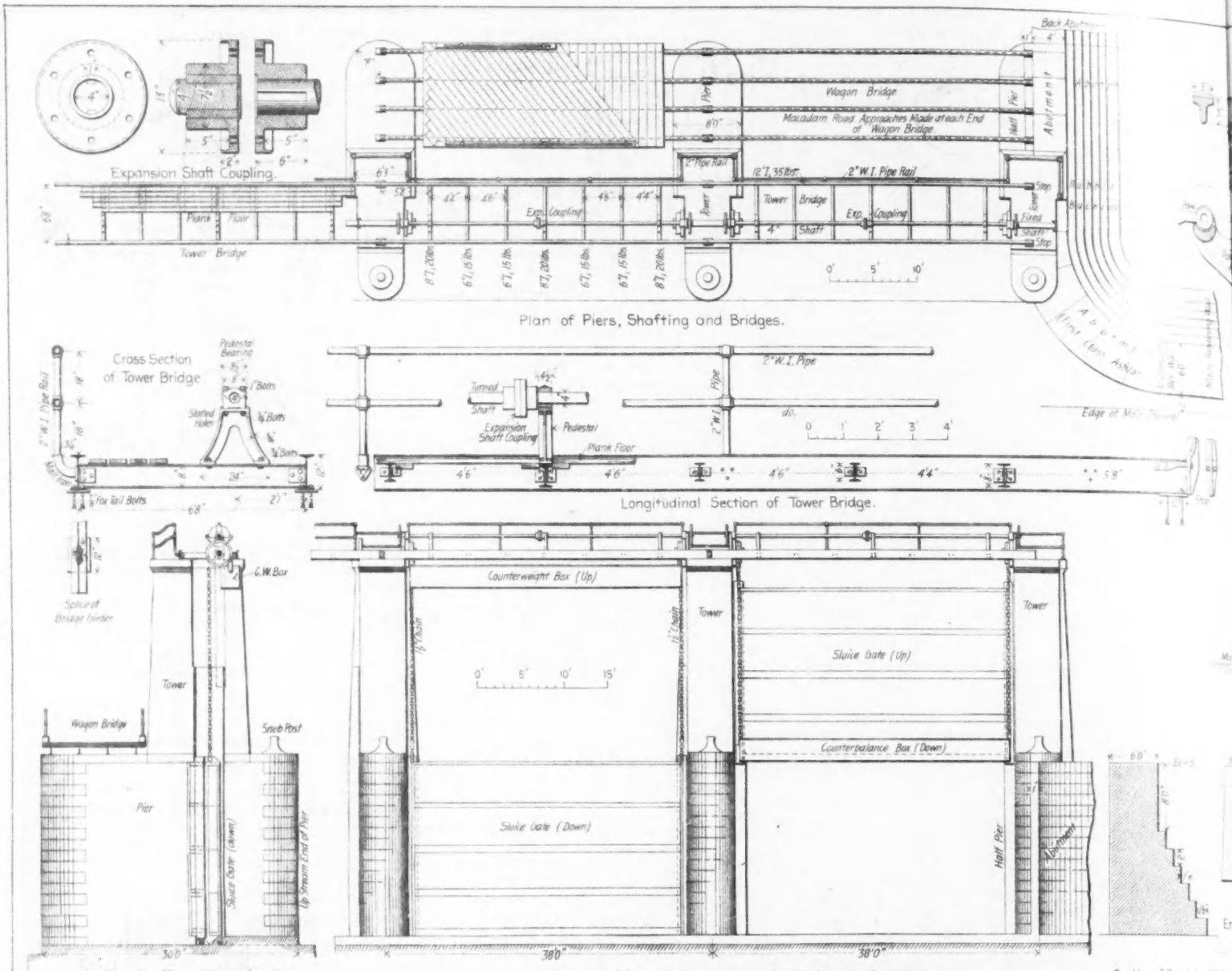


FIG. 97. GENERAL PLAN AND ELEVATION SHOWING NATURE OF MACHINERY FOR OPERATING SLUICE GATES.

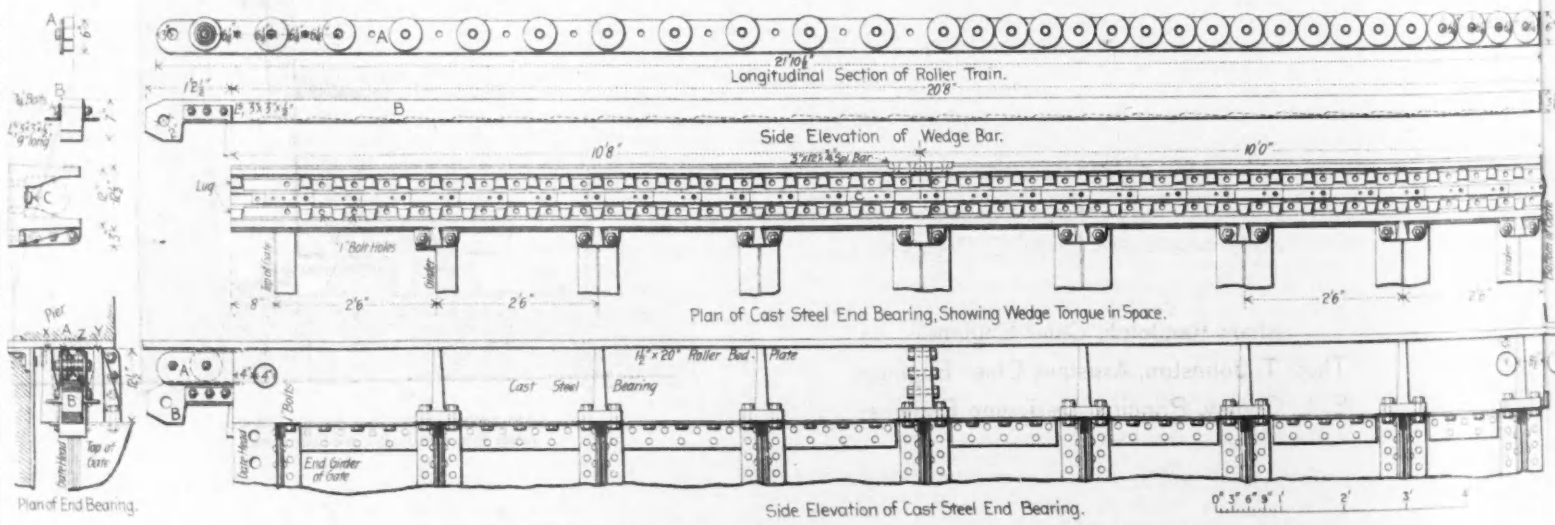
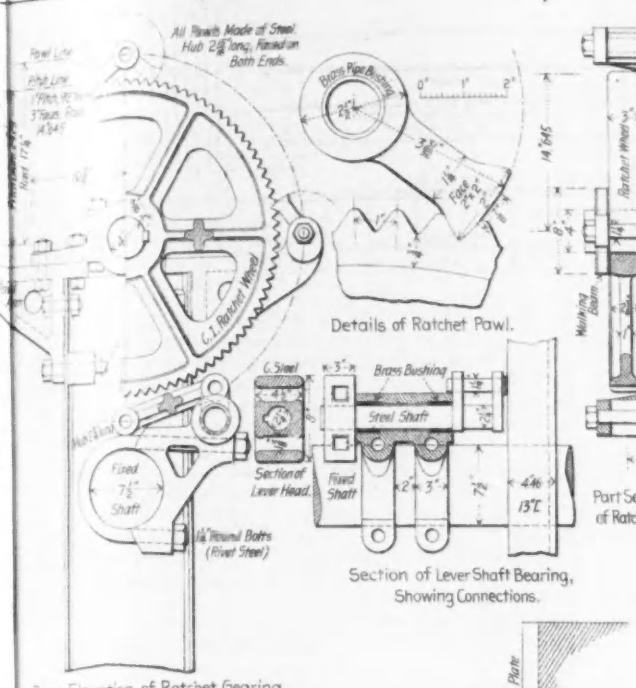
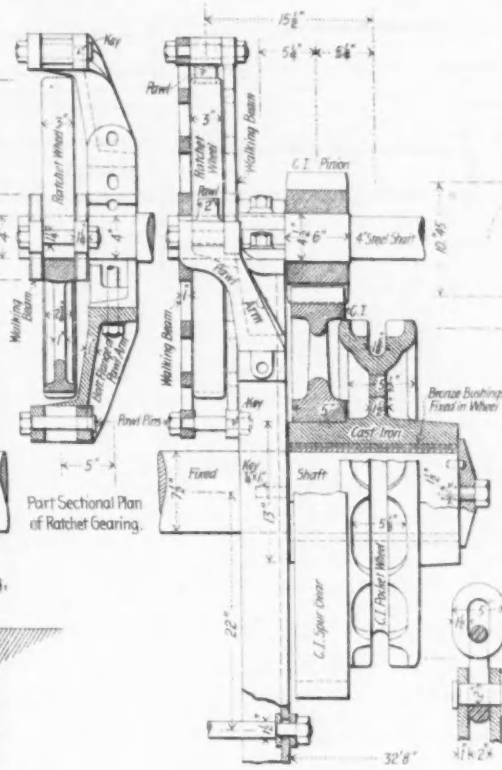
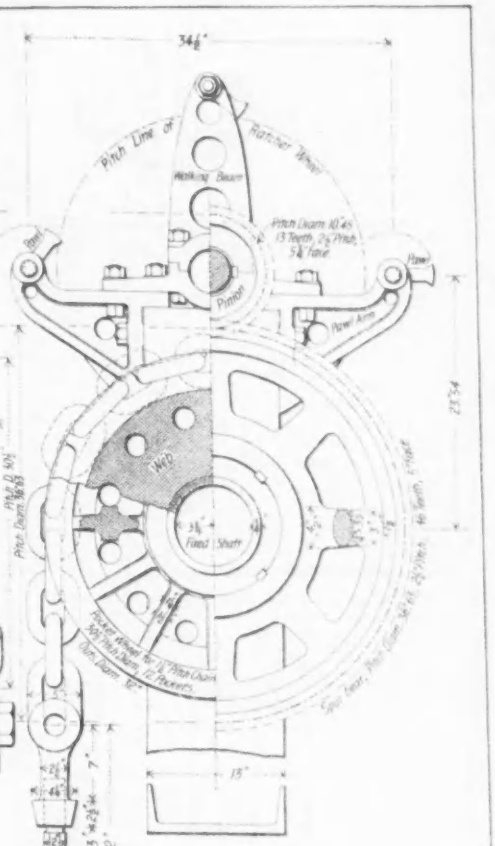
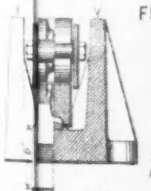

Longitudinal Section of Roller Train.
Side Elevation of Wedge Bar.
Lug
1" Bolt Holes
Girder
Plan of Cast Steel End Bearing, Showing Wedge Tongue in Space.
Pier
Top of Gate
Cast Steel Bearing
End Girder of Gate
Plan of End Bearing.
Side Elevation of Cast Steel End Bearing.

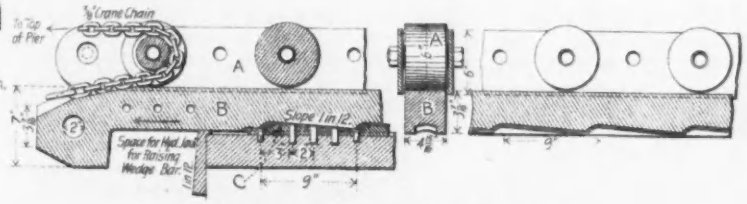
FIG. 99. DETAILS OF END BEARINGS AND ANTI-FRICTION DEVICE FOR SLUICE GATES.










⅝"Crane Chain
To Top of Pier
Slope 1 in 12
Space for Hot Iron for Raising Wedge Bar
Longitudinal Section of Roller Train, Wedge Bar and End Bearing.

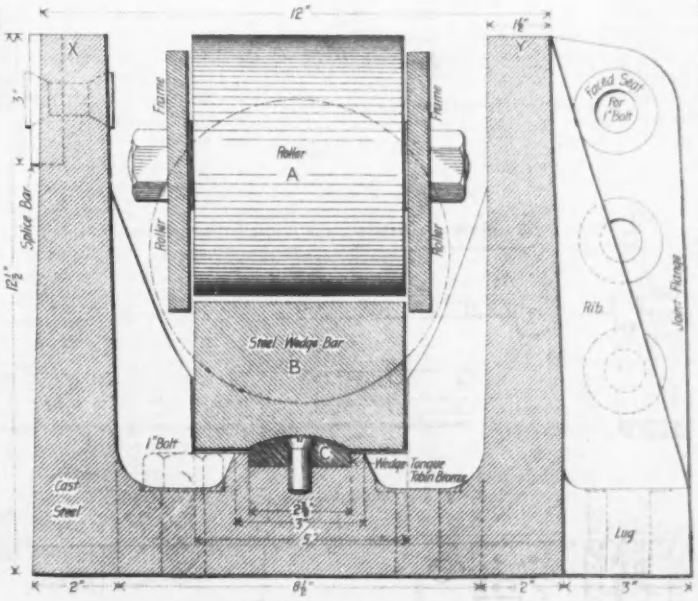


FIG. 98. DETAILS OF RATCHETS, RATCHET WHEEL AND GEARING FOR SLUICE GATE MACHINERY.

SLUICE GATES
FOR REGULATING WORKS,
CHICAGO MAIN DRAINAGE CHANNEL.

Isham Randolph, Chief Engineer.
Thos. T. Johnston, Assistant Chief Engineer.
E. L. Cooley, Principal Designing Engineer.

CHAS. HART & SONS, LITH., 26 VESEY ST., N. Y.

of such a monument in the West, it is to be supposed that this feature has been duly considered in his plan. With the general usefulness and necessity for such monuments we are heartily in accord, and it should be a self-evident fact that the comparatively small additional expense of permanently marking the results of public surveys made at a great cost is many times compensated for by the additional useful value of these surveys. To fail to provide frequent and accurate means of identification of corners and bench marks is to defeat one of the main objects of the original survey. It is only remarkable that there should be a necessity for legislation on this subject at this late date.

The experiments on the effect of temperature on the strength of wrought iron and steel, reported in the paper presented by Prof. R. C. Carpenter, at the recent meeting of the American Society of Mechanical Engineers, a brief abstract of which appears in this issue, afford a gratifying confirmation of the fact which was discovered by earlier experimenters—viz., that the strength of wrought iron and steel does not decrease, but on the contrary increases, with increase of temperature up to about 500° F. This latter temperature is beyond the highest to which metals under strain are ordinarily subjected in engineering structures. Beyond this temperature, however, iron and steel rapidly weaken, until they become red hot, when they become plastic and will flow under almost any strain.

While the general fact of increase of strength up to 500° F. is thus confirmed by Professor Carpenter's experiments, we find they do not, in particular details, agree with the results obtained by other experimenters. Thus, Mr. Jas. E. Howard, in tests made at the Watertown Arsenal a few years ago, found that the tensile strength of steel diminishes as the temperature increases from 0° until a minimum is reached between 200° and 300° F., the total decrease being about 4,000 lbs. per sq. in. in the softer steels, and from 6,000 to 8,000 lbs. in steels of over 80,000 lbs. tensile strength. From this minimum he found the strength to increase up to 400° to 650° F., the maximum being reached earlier in the harder steels, and the increase amounting to from 10,000 to 20,000 lbs. per sq. in. above the minimum strength at from 200° to 300°. Professor Carpenter's tests seem to have been made with a very good form of apparatus, and very probably they are worthy of as much credence as the work of any others in the same line, but his paper would have been much more satisfactory than it is if he had made a comparison of his results with those given by others, and explained, if possible, the discrepancies between them. It would be well if all papers which give accounts of new experimental researches would contain some reference to earlier researches of the same sort, with comparisons of results, and some statement by which the reader might be enabled to form a judgment as to whether the later results were any more reliable than the earlier. If an engineer should now ask the question: "Is iron stronger at 250° F. than at 70°, or is it weaker?" the answer would have to be "Professor Carpenter says it is stronger. Mr. Howard says it is weaker, and we don't know which is correct." Fortunately this particular question is of no practical importance, for the difference in strength one way or the other is trifling, but it may be used as an instance of the difficulty engineers in practice have in obtaining useful information from many of the published papers, which give the results of experimental research simply as isolated facts without comparing them with the results of similar investigations of earlier date.

Now that the "horseless age," or the era of "motocycles," is upon us, it behooves the journalists to bestow appropriate names upon the vehicles of the future. The newspapers have already given us "motocycle," which would seem to be as great a literary abomination as "electrocute" and "motorneer." The age of railways brought a number of new terms into the language, as railway, railway car, street car, electric car, trolley car, cable car, elevated railway, etc. The peculiarity of all these terms is that they have some relationship to old-fashioned Anglo-Saxon, and are etymologically unobjectionable, which cannot be said of the mongrel Greco-Latin derivatives "electrocute" and "motocycle." Before the day of railways, vehicles which were drawn by anything else than horses also had plain English names, as ox cart, goat wagon, pony carriage, dog sledge, etc. We suggest as the proper general term for the horseless vehicle of the future the term "motor wagon," and for special styles of the vehicle motor cart, motor carriage, motor coach, motor phaeton, motor bicycle, motor tricycle, etc. The tendency of the language to degeneracy will, of course, abbreviate the term motor wagon to motor, or even to mote, just as the elevated railway has been abbreviated to "the elevated" and even to "the L," and as in England American railway stocks has been shortened to "American rails," but let us make a good beginning at any rate, and call the new vehicle a motor wagon.

METHODS OF WORK ON THE CHICAGO MAIN DRAINAGE CHANNEL.

In bringing to a conclusion the series of articles* describing the machinery used and methods of work adopted in constructing the Chicago Drainage Channel, it seems desirable to summarize some of the more salient features of the work, which have to a certain extent been lost sight of in the mass of detail relating to individual machines and methods of excavation. Broadly classified, the main problems to be solved in constructing the drainage canal were in character and order of occurrence about as follows: (1) Selection of route and determination of the most economical cross-section; (2) control of Desplaines River and exclusion of its floodwaters from the main channel; (3) excavation of 28 miles of main channel; (4) design of works to deliver and control discharge of 10,000 cu. ft. of water per second to the Desplaines River; (5) construction of supply channel to furnish water for main channel from Lake Michigan; (6) railway changes, bridges, and minor works. The character and extent of all of these problems have been reviewed in the preceding articles as far as the progress of the work would permit, but the work of construction has called for the most particular attention. The reasons for this are plain upon a little study.

To a greater extent, perhaps, than on any other large waterway, the engineering difficulties on the drainage canal have been due to the vastness of the undertaking; the mere magnitude of the physical changes to be brought about. It is true that questions of design, and often intricate ones, have come up, but the great problem of the work has been a constructional problem—a problem of how to dig quickly and cheaply a channel through miles of earth and rock, and not a problem of how to design a channel which would drain the Chicago River when once dug. Put in homely words, it has been a problem of how to do work, rather than of what work to do. This distinction does not detract at all from the credit of the engineers who have wrought out the channel, but it is a distinction which should be fully understood. The canal is the work of the engineer as a builder.

For the purpose of reviewing the work the excavation naturally divides itself into three classes: (1) wet excavation in earth; (2) dry excavation in earth, and (3) rock excavation. The amount of each class, while impossible to exact determination, is about as follows:

Wet excavation in earth	.....	4,500,000 cu. yds.
Dry " " "	.....	23,000,000 " "
Rock "	.....	12,000,000 " "

For the wet excavation in earth dredges have been used, their construction and operation depending upon the nature of the material to be removed. On the two easterly sections of the canal the material to be dredged was a stiff brick clay, sometimes mixed with loam and sandy soil. Here dipper dredges were used, and under unfavorable conditions have averaged for that part of the work now finished about from 40 to 80 cu. yds. per hour. On special runs, with favorable conditions, these dredges have excavated from 75 to 155 cu. yds. per hour, and it seems fair to assume that with the work fully opened, they may be expected to average fully 80 cu. yds. per hour day after day.

Besides this stiff clay there have been considerably over a million cubic yards of soft muck taken out with dredges. This muck formed the bed of the Desplaines River, and existed in a layer varying from 2 ft. to 15 ft. thick, overlying a hard material. For this work hydraulic suction dredges similar to those so extensively used on the Pacific coast have been employed, but they were much smaller than the powerful machines which have made the enormous records of output in California and Washington (Eng. News, Aug. 4, and 11, 1892). With one exception, these dredges did very good work, considering their small size. Pumping through from 1,500 to 3,500 ft. of pipe, they have averaged about 170 cu. yds. per hour. The exception mentioned was the water dredge jet in which the usual construction of a revolving cutter to break up the material was replaced by a number of powerful jets of water. This dredge recorded a failure, never showing a sustained capacity of more than 35 cu. yds. per hour. The failure was largely due to the water jets, which, while they broke up the muck well enough, drove it away from the action of the suction pipe, so that instead of being sucked out, it merely floated away to settle elsewhere. The point well illustrated by this experiment is that the least possible disturbance of the material sufficing to bring it rapidly within the power of the suction, is what is wanted. Aside from the single powerful current entering the suction pipe, the less the water is disturbed the better, and this is where the revolving cutter has shown its superiority over other devices tried.

It will be noticed that the endless chain bucket or ladder dredges, so much used on the seaboard, were not employed here at all. In other words, the systems of dredging common on our inland lake and river works were adopted. On the Manchester and the North Sea & Baltic canals ladder dredges were used to the exclusion of almost all other types. No dipper dredges were employed on these works, and only a few hydraulic suction dredges, although much of the material, especially on the Baltic Canal, was well adapted for excavation by the last type of dredge. Another peculiarity which distinguished the dredgework on the European canals from that on the drainage canal was the enormous labor entailed in getting rid of the dredged material. On both the Manchester and Baltic canals the greater part of the dredged material had to be loaded into scows, and then the scows unloaded into cars hauled by railway. The machinery for transferring the scowloads was in many cases very elaborate and expensive. In respect to the easy disposition of the material, the work on the drainage canal has been particularly favorable, the spoil for the most part being dumped on the adjacent banks of the channel and generally within a few hundred feet.

This close proximity of the dumping grounds has influenced the methods of excavating in dry earth still more than it has the dredgework. The dry excavation in earth on the drainage canal has usually consisted of two processes: (1) the excavation of the material from its original bed, and (2) conveying the spoil to the dumping ground. For the excavation in hard material steam shovels have been used almost exclusively, and the work they have been called upon to do has been very severe. Not only has much of the material been of a very intractable character, but the work has been continuous, many of the contractors working their shovels day and night, with little delay, except for necessary repairs. The output of these shovels has been given in considerable detail in the preceding articles, where the character of the material and conditions of work were fully described, but a few general figures may be given here. In stiff clay weighing about

* These articles began in Engineering News May 16, 1895, and appeared weekly, with slight interruption, until the issue of Oct. 3, 1895. The two final articles, describing the controlling works, the designs for which have only recently been completed, appeared in our issue of Nov. 21, and in the present issue.

3,000 lbs. per cu. yd., the average output has been from 50 to 70 cu. yds. per hour; in very hard clay, thickly filled with boulders and requiring blasting, the average output has been from 25 to 35 cu. yds. per hour for the hardest and from 30 to 40 cu. yds. per hour for the medium material; in the cemented gravel, requiring blasting, the output has run from 25 to 50 cu. yds., depending on the hardness; and in handling blasted rock the output has been from 25 to 30 cu. yds. per hour. These figures indicate good average work, neither especially heavy runs nor very poor runs, due to special conditions, being considered. On the Manchester Canal, in England, the steam shovels used averaged 70 cu. yds. per hour in light soil and 45 cu. yds. per hour in clay, according to the best available records of that work.

The various forms of conveyors used to take the excavated material to the spoil bank are in all but a few instances modifications of an inclined plane, up which cars singly or in trains are hauled from the pit to the dumping ground. The exceptions to this system are the continuous belt conveyor and the continuous pan conveyor, neither of which has proved so efficient under all condition of weather and work as the simpler method. It is somewhat curious to note the very universal adoption of this, the oldest means of overcoming a vertical lift, in these days of powerful and speedy hoisting machinery, but a study of the conditions will show that it was the most suitable, as well as efficient, method that could have been adopted. The capacity of the steam shovels to excavate the material has in nearly every case limited the output, and no system of belt or bucket conveyors could have carried these intermittent loads as economically as the car and incline system. Another thing which has contributed to the use of cable inclines is the location of the dumping grounds close to the edge of the canal. As soon as the length of haul becomes much over 1,000 ft. the locomotive is more economical than the incline with a stationary hoisting engine, and we consequently find this classification of motive power on the canal work, according as the haul is long or short.

When the inclines with stationary engines were used, this limitation of haul necessitated the occasional movement of the incline closer to the work. Two means of accomplishing this movement were adopted on the canal work. Where the banks of the channel were naturally level, and required but little grading for tracks, the inclines were mounted on wheels or rollers, and kept close up to the work of excavation, the length of track in the pit being kept at the minimum at all times; but where the canal banks were not adapted to this nearly continuous movement of the incline, the practice was to move the incline (generally by abandoning the old structure and erecting a new one) only when the maximum economical distance of haul was reached, the cars being brought to the advancing excavation by gradually extending the tracks in the pit. The relative advantages of these two methods were determined by the conditions. The determining condition on the canal has been, as a matter of fact, the location of the spoil area and the natural advantages of the bank at any particular point for the cheap construction of a track for the incline.

The traveling inclines used on the canal were more costly to construct at first, and entailed the cost of the track on which they ran, which might be very expensive on uneven or swampy ground. The advantages in their favor were minimum distance of haul and minimum amount of track in the pit; moreover, the same incline was used from the beginning to the end of the work. The stationary inclines were very inexpensive—generally being a simple earth embankment or rough timber structure—but had to be reconstructed several times; they necessitated very much more track in the pit and a constantly increasing length of haul until the economical maximum was reached, and finally they required the use of auxiliary power in the shape of teams to haul the cars in the pit and on the spoil bank. The cheap removal of the spoil was the object of the contractors, and by integrating the various factors just mentioned with this object in view, each contractor determined the style of incline, fixed or traveling, which he used.

In what has just been said, no mention has been made of the effect of the nature of the material excavated upon the relative economy of the fixed and traveling incline, but it is obvious that this may have an important influence. For example, it has been stated that the capacity of the inclines or conveying process has in nearly all cases been limited by the capacity of the excavating plant. Now, the capacity of the excavating plant, always steam shovels, is directly controlled by the hardness of the material. In other words, the softer the material, the more closely the capacity of the excavator approaches the capacity of the conveyor, for the latter is constant for any particular plant, whether the material is hard or soft. Owing to the much shorter and more rapid haul, the traveling incline has a greater capacity than the fixed incline, which makes it especially adapted to soft earth excavation. It is important to note that on those sections of the canal where the excavation is softest the banks are best adapted to the use of the traveling incline. As a mere matter of fact, the use of the traveling incline on the canal has been determined mostly by the character of the bank and the location of the spoil bank, the character of the excavation cuting a less important figure. Other comparisons between the relative advantages and disadvantages of fixed and traveling inclines for the canal work might be made, but those noted cover the principal points.

From a structural point of view, the incline with the stationary hauling engine is a more impressive form of conveying process than the incline with locomotive engines, but the latter system has important advantages where the haul is long, and when well managed has been able to compete on the canal work with the cable incline in economy. Owing to the much larger masses or units to be moved, the extensive track system, and other inherent peculiarities of the system, the element of good management enters into its success considerably more than it does in the case of the cable incline. This is a fact difficult to demonstrate by such figures of the canal work as are available, but it stands out prominently to one who watches carefully the actual work.

Before leaving the consideration of earth-conveying system in use on the canal a few words need to be said regarding the two continuous conveyors used. The more successful one was the continuous rubber belt conveyor. This conveyor, however, was considerably affected by the weather, rain and frost causing trouble, and moreover it involved necessarily a third handling of the material between the excavation and the conveying, since the earth had all to pass through a granulator to get in shape to be carried by the belt. This introduced a third set of machinery to repair and maintain. The continuous pan conveyor showed its ability to carry the material, but the first cost and the cost of operation were so great that an immense amount of material had to be handled per hour in order to make it economical as compared with more simple devices, and no satisfactory method was found to excavate and load this material. The system of power plows designed for the excavation and loading could not be made to work satisfactorily in the hard clay, and here the machine failed.

It is probable that the hardness of the material would have likewise prevented the success of any device like the continuous bucket excavators, so much used on the Manchester and the Baltic canals. In a hard, boulder-filled earth the steam shovel has peculiar advantages which no continuous moving, scraper-acting excavator possesses. A human intelligence directs the dipper through the craneman, and when a boulder is encountered which cannot be torn out at once, it can be undermined and loosened by intelligently manipulating the dipper. This flexibility of the excavating tool is not had in the continuous bucket excavator. As an example of this fault of the scraping tool, the scraper used to handle muck on Section 6 may be mentioned. This scraper was a success in the muck, but failed entirely when the boulder-filled glacial drift was encountered.

Turning now to the rockwork, it will be seen that here, as in earth, the work consisted of two processes—viz., the excavation proper and the conveying of the spoil from the pit. The excavation process consisted in all cases of channeling, drilling, blasting and loading, and the methods of doing these different parts of the work were nearly the same on all sections. The channelers were self-contained machines, each generating its own power for locomotion and for operating the cutter. On the work as a whole the channelers averaged from 8 to 10 sq. ft. of cut per hour at a cost offrom 8 cts. to 25 cts. per sq. ft., depending upon the character of the rock and conditions of work. The approximate average cost of channeling for the whole work was not far from 17 cts. per sq. ft., or about 6 cts. per cu. yd. of rock excavated. On all but one section, where steam was used, the drills were operated by compressed air, piped from central compressor plants. Despite the very considerable first cost of the central compressor plant, it has proved its economy and efficiency wherever used. The cost of drilling has run from 7 cts. to 15 cts. per cu. yd. of rock excavated. Dynamite has been the explosive most extensively used, and nearly always the blasting process has been to break down a breast extending transversely across the channel. A row of skips or cars was then strung across the canal at the front of the breast, and the broken rock loaded by hand.

This extensive use of manual labor in loading the rock has made the element of management and superintendence a more important factor in the rock work than it was in most of the earth excavation. Generally from 35 to 45 men were worked loading on each breast, and the output depended very largely upon the ability with which these men were handled to prevent "soldiering," delay in getting the skips or cars in place, interference of the men with each other and a dozen other things which the managers of labor will understand. The better measure of the efficiency of any system of work in rock is therefore the output per man per hour, and not the output per day from the breast worked, and this method of comparison has been used in the description of the rockwork.

The methods of conveying the material from the pit which were most used were the stationary cable incline, the Lidgerwood traveling cableway and the Brown cantilever hoist, fully five-sixths of the rock having been handled by these methods. The output per man per hour with these different methods has been about 0.7 cu. yds. for the incline and 1 cu. yd. each for the cableway and hoist. In each of these systems the mass to be moved is practically confined to the weight of the rock and the car or skip in which it is carried. In other words, nearly all the power expended is applied to moving the material which pays. In the great double-boom derricks used on certain parts of the work the contrary is the case, and they worked at a corresponding disadvantage. The efficiency of the cable incline is particularly notable when the cost of the plant is considered in comparison with that of other conveyors. Its disadvantage lay in its slowness of operation and the large amount of manual labor required in handling the cars after loading. In these respects the cantilever hoist and traveling cableway excelled all other devices. The cantilever crane especially was remarkable in the quickness of its operation and mechanical handling of the skip when once loaded, and notably in its rapid movement along the work.

The cantilever hoist, derricks and inclines for handling rock were all well-developed systems for handling heavy materials, like coal and ores in fragmentary masses, and very few modifications had to be made to adapt them to the canal work. With the cableway the case was different. This machine had, indeed, been long used, but never where its frequent movement with the progress of

the work was necessary, nor where the load was of no value, and the prime essential of its conveying was to get rid of it in the quickest possible way. As a consequence the traveling towers and the mechanism for dumping the load in mid-air without stopping the skip were distinctly novel modifications of the cableway as it had been known, which owed their development to the necessities of the canal work. This is all the more noticeable since very few of the appliances used on the canal are really new inventions developed by this particular work, although the resurrection of old appliances, improving their construction and operation, adapting them to new conditions and combining one with another to make a new machine, are to be noticed everywhere.

The salient mechanical features of the drainage canal work have been covered, although very briefly, in the foregoing paragraphs, and in the descriptive articles—of which this is a review—these features will be found explained in detail. It is a pretty good proof of the success of the methods adopted that the nearly 40,000,000 cu. yds. of unusually hard earth and solid rock excavation is being done at a cost of 28.94 cts. per cu. yd. for earth and 76.31 per cu. yd. for solid rock, including contractors' profit. While these figures may appear large compared with those of foreign canal work, it must be remembered that in no foreign canal, except the Corinth, has the material been so hard throughout, and in no foreign canal work have the wages of labor been so great. As a matter of fact, it is probable that if the work was to be let again, it would be contracted for at considerably lower prices than it was this time.

It would be hardly proper to conclude without some reference to the purpose for which the drainage canal is being constructed. Primarily the purpose of the canal is to purify the sewage-laden waters of the Chicago River and prevent their outflow into Lake Michigan to pollute the water supply of Chicago, but secondarily its promoters had in mind its use as a part of a deep waterway to the Gulf of Mexico. Indeed, it is probable that in the minds of some of the canal's most energetic promoters the waterway feature of the work was placed foremost. Without any expression upon the advisability or inadvisability of the nation's constructing a deep waterway from the Lakes to the Gulf, it is evident that a very considerable portion of the cost of such a work has been paid for when the drainage canal is completed. The construction of the canal has practically determined the route—viz., the Desplaines-Illinois-Mississippi River route—which any future waterway between the Lakes and the Gulf must follow. The deep-waterway feature of the canal is, however, a question which may be safely left to the future, but its proper handling, to develop best its usefulness as a sanitary work, calls for immediate attention.

Unfortunately the city of Chicago years ago committed the mistake of emptying many of its sewers directly into Lake Michigan. This may have been a natural enough mistake, but a mistake it certainly was, and that city is just now discovering it to the tune of the many hundreds of thousands of dollars which the construction of intercepting sewers to empty into the canal will entail. But whatever the cost may be, these intercepting sewers must be constructed, and the time is none too soon for the work to be begun. The recent alarming increase in typhoid fever in the city shows that there will be no safety until all the sewage is cut off from the water supply. This sewer work devolves entirely upon the city of Chicago, and is not a part of the canal work proper, as controlled by the Trustees of the Sanitary District.

Another feature of the canal work, which has nothing to do with its sanitary usefulness, but which is deserving of serious attention, is the possible development of water power at the west end of the canal. The engineers of the Sanitary District assert unofficially the feasibility of developing 80,000 HP. within a stretch of a few miles between Lockport and Joliet, and by electric transmission the larger part of this can be made available for electric lighting or power in the city of Chicago. Until reliable estimates are made of the cost of developing this power, it is little use to speculate upon the possible income from it, but it would seem to be a question well worth looking into. It may prove a means of reimbursing the taxpayers for a part, at least, of the money expended in constructing the Chicago Main Drainage Channel.

LETTERS TO THE EDITOR

THE PROPER CONSISTENCY OF CONCRETE AFTER MIXING.

Sir: In your issue of Nov. 21, 1895, a criticism was made by "S. F. X." on the specifications for concrete used on the regulating works for the Chicago Drainage Canal, and a detailed reply by Mr. Thos. T. Johnston; and as I have the results of some experiments bearing directly on the point at issue—viz., proper amount of water for cement mortar—I send them to you. It seems to be the general impression, especially among college men, that all mortars must be mixed as dry as possible. It has been my experience, however, that mortars with a considerable amount of water in them give the best results and also the greatest strength after a long time. The dry mortars, however, give the best results on short-time tests. The fact that artificial stone and cement sewer pipe are made out of very dry mortar does not prove that it is best to make them that way. It does prove, however, that it is easier and cheaper to make these articles out of a very dry mortar; but a much stronger product would be obtained if more water were used. In that case the stone or pipe would have to be left in the molds until the cement had taken a considerable set, whereas the dry mixtures can be removed at once from the molds. In making mortars from cement I have usually found that it is not necessary to say to the workmen anything about making the mortar wet, as the general tendency among them is to use too much water, because the wetter the mortar is, the easier they can get it into the crevices in the masonry or brickwork.

In the accompanying table it will be seen that on short-time tests the lower the percentage of water, all other quantities being constant, the greater the strength of the briquettes; and that on the long-time tests, the greater the percentage of water, the greater the strength of the briquettes.

Yours truly,

A. S. Cooper,
U. S. Assistant Engineer.

Savannah, Ga., Nov. 26, 1895.

Table Showing Effect of Different Proportions of Gaging Water Upon the Strengths of Cement Mortars at Different Ages.

		7 days.			56 days.		
Size of sand.	Per cent. water.	No. of tests.	Mean strain.	Greatest dif. from mean.	No. of tests.	Mean strain.	Greatest dif. from mean.
80 to 100	16.4	4	24	3	4	78	12
80 " 100	12.7	4	24	3	4	70	4
20 " 30	11.3	4	35	6	4	80	8
20 " 30	12.7	4	42	3	4	93	14
20 " 30	14.2	4	42	2	4	107	7
20 " 30	14.9	4	48	3	4	119	14
20 " 30	16.4	4	41	2	4	131	11
70 " 80	14.9	3	37	1	4	91	10
70 " 80	16.4	4	31	2	4	107	5
70 " 80	18.0	4	28	3	4	117	10

Note.—The mortar was composed of one part sand and one part natural cement by weight. The figures denoting the size of the sand indicate the number of meshes per lineal inch of sieve; for example, an 80 to 100 sand is one which will pass through a sieve of wires per lineal inch, and be held on a sieve of 100 wires per lineal inch.

CALORIMETRIC PYROMETERS.

Sir: Referring to the article in Engineering News of Nov. 14 on pyrometers, p. 324, in regard to the calorimetric pyrometers, often called platinum ball pyrometers, I wish to call your attention to the fact that Hoadley's recommendation to use iron platinum as a ball has been shown to be extremely unwise. Of all materials for such pyrometers, iron is probably the least suitable, because of its violent and abrupt changes in specific heat. The specific heat which you quote is very far from right, and I think it would be well to correct it.

In Vol. XVIII., "Trans. Am. Inst. Mining Engineers," 1889-90, p. 728 you will find a description, which I wrote, of a calorimeter which I used for determining high temperatures with great accuracy. It was designed with the assistance of Professor Holman, and with the experience of Mr. Hoadley's calorimeter before us.

Hoadley's calorimeter was based on essentially wrong principles. He endeavored to keep the heat in his calorimeter by felting it—a radically wrong method. The correct method, and that which I used, is to insure uniform, and therefore measurable, loss of heat from the calorimeter by surrounding it with a body at constant temperature.

Yours faithfully,

H. M. Howe.

287 Marlborough St., Boston, Nov. 23, 1895.

(The specific heat of wrought iron given in our article, as stated by Petit and Dulong, was 0.1098 from 32° to 42° F., and 0.1255 from 32° to 662° F. The temperature 42° F. is a typographical error, and should be 212° F. Other values by Petit and Dulong are 0.115 from 32° to 392° F., and 0.1218 from 32° to 572° F. Mr. J. C. Hoadley, in "Trans. Am. Soc. M. E.," Vol. VI., p. 713, gives the results of a number of determinations of mean specific heat between 32° F. and various other temperatures, a few of which are as follows: 0° F., 0.10587; 32° F., 0.10687; 100° F., 0.10915; 200° F., 0.11290; 400° F., 0.12184; 800° F., 0.14542; 1,600° F., 0.21544; 2,000° F., 0.26187. The figures given by Mr. Hoadley do not appear to show the violent and abrupt change stated by Mr. Howe, but, on the contrary, a regular law of increase. Mr. Hoadley states ("Trans. Am. Soc. M. E.," Vol. VI., p. 712) in regard to the comparative merits of the solid platinum and the compound platinum and iron balls, that he had two of the compound balls and often used them at moderate temperatures, 1,000° to 1,200° F., in direct comparison with solid platinum balls without detecting any important discrepancies in the result. We have no doubt that Mr. Howe's method—that of surrounding the calorimeter with a body at constant temperature (an annular vessel filled with water)—is more scientifically accurate than Mr. Hoadley's method—that of felting it; but the latter is sufficiently accurate for commercial work, in which relative rather than actual temperatures are desired.—Ed.)

PERFORMANCE OF A SEA-GOING HOPPER DREDGE ON THE COLUMBIA RIVER.

Sir: In connection with the sea-going hydraulic dredge described in your issue of Nov. 7, your readers may be interested in a description of a similar dredge built in 1893 by Major Thos. H. Handbury, Corps of Engineers, U. S. A., for service on the lower Columbia and Willamette rivers, in Oregon. The dredge is briefly described in the report of the Chief of Engineers for that year. Its general dimensions are, length over all, 143 ft. 6 ins.; length between perpendiculars, 128 ft. 6 ins.; beam, 38 ft. 4 ins.; draft, light, 8 ft.; draft, loaded, 20 ft.

There are four bins forward of the boilers and machinery, into which the dredged material is delivered. These have an aggregate capacity of 500 cu. yds. The material is discharged from these through a hole 2 ft. 5 ins. in diameter in the bottom of each bin, these holes being closed by cast iron stoppers, having the form of segments of spheres, which are hung upon iron rods with two joints extending to the deck of the boat. The upper end of each rod terminates in a screw, on which is fitted a nut in the form of a large hand wheel, which serves to raise and lower the stopper.

The propelling machinery consists of one compound surface condensing engine, with cylinders 17 and 34 ins. diameter and 24-in. stroke; two Scotch type steel boilers, 9 ft. 3 ins. diameter, and 10 ft. long, each having two furnaces, 36 ins. diameter, and 124 return tubes, 3 ins. diameter. A condenser, circulating and air pumps, and other necessary parts were provided. This machinery was furnished by Neafie & Levy, of Philadelphia, Pa.

The hydraulic machinery, which was furnished by Joseph Edwards & Co., of New York, consists of two 15-in. centrifugal pumps, with suction and discharge of the same size. One pump is placed on each side of the vessel, with its suction pipe reaching out over the side and aft down into the water to the material to be dredged, which may be at a depth of 36 ft. The discharge is forward into the bins. Each pump is driven by an Ideal engine, with cylinder 15 ins. diameter and 14 ins. stroke, connected to the pump by a belt running over 36-in. pulleys. The engines are designed to give 260 revolutions per minute to the pumps. The usual rate of speed at which they are worked is about 240 revolutions.

The boat is furnished with two hoisting engines, for raising and lowering the suction pipes, and a steam capstan for general purposes; also with a Worthington pump, 10 × 6 × 10 ins., for washing out the bins and assisting in the dumping. Accommodations are furnished for a crew of 18 men. The vessel was named "William S. Ladd," after the late William S. Ladd, of Portland, Ore., the first president of the Port of Portland Commission, an organization authorized by the legislature of the state of Oregon, for the purpose of obtaining a channel from Portland to the sea, having sufficient depth to enable vessels of any draft to sail fully loaded from that port. The cost of the boat, including the outfit, was $66,000.

This dredge was designed as a sea-going vessel, to work upon any of the ocean bars upon the Pacific Coast where its services may be necessary. Thus far,

however, its work has been confined to the Columbia and Willamette rivers. During the two years that it has been in service, it has given very satisfactory results. In the Chief of Engineers' report for 1894 it is shown that the total cost per yard of the material removed during a season of seven months was less than 6 cts. The average cost per month for operating the dredge during this time was $2,893. The operations for the fiscal year of 1895 were equally satisfactory.

It is not an uncommon occurrence for this dredge, when working under favorable conditions, to excavate and move to a distance from ½ to ¾ mile 4,500 cu. yds. of material in a day of 10 hours. Under these conditions, it takes 25 minutes to fill the bins, the two pumps delivering sand at the rate of 18 cu. yds per minute. After the dredge has arrived at the dumping ground, seven minutes are consumed in emptying the bins. Hydraulic Dredge.

NOTES AND QUERIES.

The Christy Fire Clay Co., of St. Louis, Mo., writes us, referring to the article on pyrometry in our issue of Nov. 14, that it has made some interesting tests recently of the temperatures of glass-melting tanks, using the Seger cones, which method they consider to be the best and cheapest in use for measuring high temperatures in tanks and furnaces in glass houses.

W. B. H., Panther, McDowell county, W. Va., wishes to know the horse-power of the largest pumping engine in the United States, and also, the diameter of its flywheel. If, by this question, is meant the pumping engine of the greatest horse-power, rather than largest pumping capacity without regard to lift or power, the answer, so far as our knowledge goes, is 3,000 HP., with two 30-ft. flywheels, each weighing 92 tons. This machine is located at the mines of the Lehigh Zinc Co., near Bethlehem, Pa., and is used for drainage purposes. It was designed by Mr. John West, and was described briefly in our issue of Oct. 19, 1893, in an article on the Chapin mine pumping engine, at Iron Mountain, Mich., published in Engineering News for Oct. 19, 1893. The zinc mine pump lifts 17,000 gallons per minute, or about 24,600,000 gallons a day, from a depth of 300 ft. The Chapin mine pump is remarkable for the great head to be overcome, having been designed to lift 3,200 gallons per minute, or 4,600,000 gallons a day, from a depth of 1,500 ft., which requires some 1,200 HP. The flywheel is 40 ft. in diameter, weighs 100 tons, and the engine was built by the E. P. Allis Co., of Milwaukee, Wis. If, instead of horse-power, pumping capacity is our correspondent's measure of size, the river flushing engine at Milwaukee, Wis., doubtless heads the list, as it has a daily capacity of 525,000,000 gallons, but with a lift of only 4 ft., which would give some 525 HP. This pump is something like a screw propeller, and is driven by vertical engines. Another notable pump at Milwaukee is one of the centrifugal type, having a daily capacity of 70,000,000 gallons, with an 18-ft. lift. It is used to pump sewage, and both it and the flushing pump were built by the E. P. Allis Co., of Milwaukee. Coming now to pumping engines for city water-supply service, the Worthington, Holly and Allis companies each have built 30,000,000-gallon pumps, but which company has the honor of the largest horse-power we cannot say. If any of our readers know of larger pumps, either in capacity or horse-power, than those named above, we shall be pleased to hear from them.

The rams of our new battleships are to be 9 ft. below the water level instead of 5½ ft., as proposed in the Department plans, according to the recommendation of the special board appointed by Secretary of the Navy Herbert for this purpose. The French place the ram on the water line, and the English place it 11 ft. below this line, consequently the Department plan was a compromise between these two ideas. The U. S. battleship "Texas" was built on the English plan.

Bids for the construction of battleships Nos. 5 and 6 were opened at the Navy Department, on Nov. 30, as follows:

On Department Plans.

Bidders.	For one vessel only.	For both, each.
Newport News Co.	$2,350,000	$2,250,000
Union Iron Works, San Francisco.	2,740,000	2,640,000
Cramp & Sons, Philadelphia.	2,820,000	2,750,000

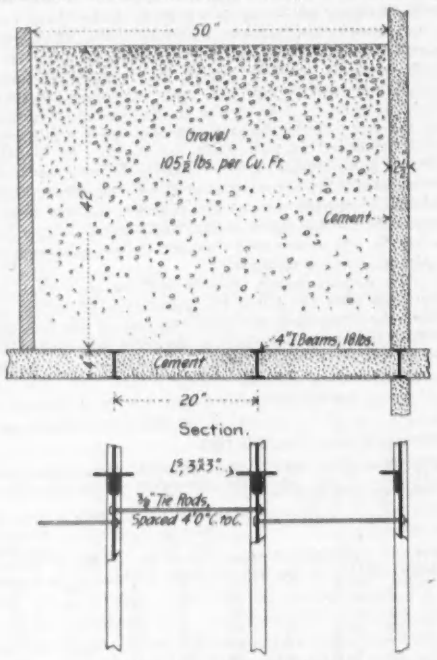
On Plans Proposed by the Builders.

Union Iron Works, San Francisco.	$2,650,000	$2,640,000
Cramp & Sons, Philadelphia.	2,500,000	2,450,000

In addition to the above Cramp & Sons offered to build three battleships, on plans prepared by themselves and containing the special features with reference to armament, for $8,000,000, including hull and armor for two ships. They also offered to build two vessels for $3,850,000 each, including hull, armor and gun-protection; or one vessel without armor for $2,500,000, or both for $2,450,000 each. It should be noted that in previous construction the government furnished all armor required.

TESTS OF THE STRENGTH OF A NEW FIREPROOF FLOOR.

A test was recently made by the Building Department of New York city to determine the strength of a new form of flooring used in a building now nearing completion on 72d St., east of Avenue A. The structure is to be used for tenement purposes, and a cheap,and at the same time, a strong, floor construction, and one approximately fireproof, was sought for in its design. The floor which has been adopted in this case consists of 4-in. 18-lb. wrought iron I-beams placed on an average 20 ins. apart, with spans as long as 13 ft. Two ⅝-in. tie rods are used in each span length, and at a point about 3 ft. from the middle of the beam each way short pieces of angle-iron are riveted to the web of the beam on each side. These angles are 3×3 ins., and of such a length as to just fill the space between the flanges. One leg is riveted to the flange of the I-beam, the other projects out into the space between the beams. This completes the ironwork of the floor, and after it is in place the whole space between the beams is filled solid with a concrete made up of furnace-slag



Part Plan and Cross-Section Showing Construction of Thin Fireproof Floor with Test Load of Gravel.

cinders and Portland cement, in proportions which we have not been able to secure. This composition is filled in even with the top flanges of the floor beams on both top and bottom, and, when hardened, it makes a very strong and solid floor, and is fireproof, save for the exposed flanges of the beams, a fault easily remedied. It may be interesting to note that the roof of the building is of like construction, and that the walls and partitions are built of the same material, the latter being 2½ ins. thick.

The method of testing consisted simply in loading the floor with certain uniformly-distributed loads, and noting the deflection in the ceiling below. A room about 13×8 ft. was chosen, and a rough board partition built lengthwise down the center. The half-floor space thus formed was covered to a depth of 42 ins. with gravel, which actual trial showed to weigh 105½ lbs. per cu. ft. The deflections were read in the room below. A vertical standard fixed to the ceiling pointed downward, and bore upon the short arm of a long lever with floor supports. The ratio of the lever arms was 10 : 1. Readings were taken with the gravel load at 14, 24, 30, 36 and 42 ins. depth, the gravel being leveled off to approximately a uniform depth each time. The corresponding actual deflections in inches were respectively 0.006, 0.012, 0.014, 0.025, 0.050. The load per square foot corresponding to the last deflection is 369 lbs.

It is interesting to compare this maximum deflection with that which the same beams would undergo without the concrete filling, if loaded uniformly with the same total weight. With the spacing and weight above noted, the load upon each of the I-in. beams was a little over 8,000 lbs. The safe distributed load for a 4-in. 18-lb. beam of 13-ft. span, according to the Pottsville Iron & Steel Co.'s pocket-book, is 1,360 lbs., and the corresponding deflection is 0.6 in. It is evident from this, that with 8,000 lbs. load, the elastic limit would be passed, and complete failure of the beam would result, were it not that a good share of the load is carried by the concrete itself.

As might be expected of such a monolithic construction, the floor was exceedingly stiff. Tests by four men jumping together in various parts of the floor caused scarcely a perceptible vibration. The partitions were subjected to eually severe treatment by pounding, and were found to be as solid as the floors.

The advantages of this construction—its cheapness, and the very small space taken up by the floors, walls, and partitions—are too obvious to demand comment.

The inventor of this method of floor construction, and the builder of the structure in which it has been described as being used, is Mr. G. Knoche, 501 East 71st St., New York.

PERFORMANCE OF LOCOMOTIVES OF THE COLUMBIA TYPE; P. & R. R. R.

In our issue of Dec. 5, we illustrated and described a new single expansion locomotive of the Columbia type, built for the Chicago, Burlington & Quincy R. R., and referred to the extensive use of compound engines of this type on the Philadelphia & Reading R. R. since 1891. We are indebted to the Baldwin Locomotive Works, of Philadelphia, Pa., for some records of the performance of these compounds in 1893, from which we tabulate two runs, as follows:

Wayne Junction to Bound Brook; 6 cars, 270 tons.

	Miles.	Time, mins.
Wayne Junction to Jenkintown	5.8	9
Jenkintown to Bethayres	4.2	4
Bethayres to Somerton	3.2	3
Somerton to Neshaminy Falls	2.0	2
Neshaminy Falls to Langhorne	2.7	2
Langhorne to Woodbourne	2.6	3
Woodbourne to Yardley	4.3	5
Yardley to Trenton Junction	2.1	2
Trenton Junction to Pennington	5.1	7
Pennington to Hopewell	4.7	4½
Hopewell to Skillman	3.2	2½
Skillman to Belle Mead	4.1	3
Belle Mead to Weston	6.2	5
Weston to Bound Brook	3.8	2

Camden to Atlantic City; 17 cars, 671 tons.

	Miles.	Time, mins.
Camden to W. Collingswood	3.1	7
W. Collingswood to Audubon	1.4	4
Audubon to Magnolia	3.4	3
Magnolia to Clementon	4.1	4
Clementon to Williamstown Junction	5.0	8
Williamstown Junction to Cedar Brook	2.9	3
Cedar Brook to Winslow Junction	4.6	4
Winslow Junction to Hammonton	3.1	4
Hammonton to Elwood	6.2	5
Elwood to Egg Harbor	4.9	5
Egg Harbor to Brigantine Junction	4.8	6
Brigantine Junction to Pleasantville	7.0	7
Pleasantville to Atlantic City	5.0	6

The profile of the former line was given in our issue of Aug. 29, 1895, and the latter has a mainly easy profile with three short maximum grades of 1 and 1.1% against the train. The results were very uniform and regular,and the average speeds on several runs were 54 to 56 miles per hour, including stops (or 56 to 65 without stops) from Wayne Junction to Bound Brook, the highest average being 77.1 miles per hour from Hopewell to Weston, 13½ miles. On the Atlantic City R. R. the average speeds for the 55½ miles were from 50.5 miles per hour with 17 cars (671 tons) to 54.6 miles per hour with 11 cars (456 tons), and 58.4 miles per hour with 9 cars (371 tons). The builders state that the performance of these engines during 1894 and 1895 has fully equaled the speed and regularity of service of 1893. These engines, one of which was shown in our issue of June 15, 1893, have the following general dimensions:

Driving wheels, diameter	6 ft. 6 ins.
Wheelbase, driving	6 " 10 "
" total	23 " 4 "
Weight, on driving wheels	82,700 lbs.
" total	129,700 "
Cylinders, h. p. (2)	13 × 24 ins.
" l. p. (2)	22 × 24 "
Boiler, diameter	4 ft. 9½ "
Firebox	9 ft. 6 ins. × 8 ft. ⅛ in.
Capacity of tender tank	4,000 gallons

We take the opportunity here to correct the statement made in our issue of Dec. 5 to the effect that the C., B. & Q. R. R. engine has steel frames. This should have applied to the plate frames of the tender, the engine having hammered iron frames made in two sections. We may also explain that the "steeled cast iron" of the driving boxes is an ordinary tough cast iron with a sufficient mixture of steel to harden them and raise the tensile strength to about 35,000 lbs. per sq. in. The surfaces are not chilled or case-hardened.

WIDE FIREBOXES FOR LOCOMOTIVES.

The advantages and disadvantages of wide fireboxes for locomotives was discussed at some length at the November meeting of the Western Railway Club. This discussion was developed by a paper on "Wide Firebox Locomotive Boilers," read at the October meeting of the club, by Mr. J. Snowden Bell, in which a brief history of the development of this device in the United States was given, with considerable material tending to show its advantage over the usual narrow firebox in more common use. The exact opinions of Mr. Bell are given in the closing paragraphs of this article and will sufficiently explain the reasons for the discussion, which was in substance as follows:

Mr. Wm. Forsyth (C., B. & Q.).—Mr. Bell raises the question as to whether a wide firebox and large grate area are desirable. It seems to me that the size of the grate is to be regulated by the intensity of combustion necessary for the production of the steam required. In a common stove we have a rate of combustion of about 5 lbs. per sq. ft. of grate per hour, and in a narrow firebox locomotive with the most intense combustion we have a rate of about 200 lbs. per sq. ft. of grate per hour. Judging from the numerous tests which have been made, showing that the economy of coal burning decreases as the rate of combustion increases above 100 lbs. (or perhaps above 60 lbs. with low-grade fuel), we decided that a rate of combustion of from 100 lbs. to 125 lbs. per sq. ft. of grate per hour was as high a rate as we ought to have, and in designing our new passenger locomotive (Eng. News, Dec. 5, 1895), we gave the grate an area of 45 sq. ft., which provides for a rate of combustion of about 112 lbs. per sq. ft. per hour. Now, with an increase in grate surface in locomotives there has not been a proportional increase in heating surface. Mr. Bell says in the first part of his paper that in making boilers attention has been paid principally to enlarged heating surface, which is obtained largely through the tubes; the heating surface has not grown in proportion to the larger grate surface. In the Wootten boilers, which are so wide, the heating surface, to absorb the large amount to be burned on this grate, has not increased nearly as rapidly as the grate has increased. In getting large capacity in a locomotive we have, I think, nearly reached the limit to which we can go in a production of steam with these large boilers without enormously increasing the weight with the ordinary type of locomotive boiler. It seems to me that in the development of locomotive boilers requiring much larger steam capacity, a water-tube boiler might be made to be successful, and I have made a plan of something of that kind, in which I obtained a heating surface in the firebox of 579 sq. ft., which is from four to five times the heating surface in an ordinary locomotive firebox. In this design also there are no staybolts, except in the front leg, and the firebox can be made as wide as the road limits will allow, so that, although that design as it is may not be entirely practicable for locomotives, yet it meets the requirements of a large grate, of dispensing with staybolts almost entirely, and of providing an increase in heating surface much larger than the grate surface is increased.

Mr. Geo. Gibbs (C., M. & St. P. Ry.).—We have had very little experience with large grate area boilers, except one or two of the extreme shallow firebox type on top of the frames, and with those we have not had very satisfactory experience in burning our coal. The type of boiler used in the Chicago, Burlington & Quincy locomotive is, it seems to me, the best that has been brought out, up to date, to cover the requirements of large grate area and other necessary conditions for perfect combustion with Western coal. The proportions adopted in the Burlington engine for grate area are, I think, about right for the heaviest type of passenger engine, although excessive for anything but continuously heavy service. I find that our passenger engines having about 18 sq. ft. of grate area, frequently burn over 200 lbs. of coal per sq. ft. of grate area per hour. We have found the economy of combustion under these conditions to be very low. With the Burlington engine, at 44 sq. ft. of grate area, the rate of combustion would be 90 lbs. for the same amount of steam-producing power. I agree with Mr. Forsyth that from 100 to 125 lbs. is the proper amount to burn for best all around conditions with our Western coal. By going below that you can get slightly better evaporative results per ton of coal, but other conditions come in then in maintaining a proper state of incandescence of the fuel and proper covering of the grate, which makes it inadvisable to go below about 100 lbs. at any time as a minimum for heavy service.

Mr. G. W. Rhodes (C., B. & Q.).—The objection to using extremely wide fireboxes in the West is that their success depends largely upon using slack coal, and this we do not have. In 1881 the C., B. & Q. purchased two Wootten firebox consolidation engines. These engines were first used in western Illinois, and were not doing very well. They could not be forced without running out of steam. During the Chicago Exposition of Railway Appliances, Mr. Wootten ran his exhibition engine on a trial trip on the C., B. & Q. road, but refused to use lump coal, and substituted slack coal. We afterward tried slack coal on our two Wootten engines and found that they worked well; in fact, were almost wild with steam. Notwithstanding these results, we decided, after six or seven years more experience with the Wootten engines, that they were not suitable for our service.

The principal reason was that we did not have the coal. Another reason was that the engines were very expensive to maintain. The fireboxes gave out in about half the time that the ordinary firebox would, and the repairs from broken staybolts were constant, so that in place of having an engine which you might call a road engine, we had an engine which was, compared with some of the others, a shop engine, and as you all know, that is not a profitable engine to have on a railroad. The water that we use out in the West is largely responsible for this. It has an entirely different effect on boilers from the waters used in the East, and perhaps I cannot illustrate this in any better way than to call your attention to the fact that in the East a set of boiler tubes will last in a locomotive boiler, without taking them out, from 10 to 11 years (the late Mr. Lauder gave me this data from his road); and you all know that the common way of supporting arch brick is on water tubes, that the water-tube grate is not at all an uncommon thing in the East, and the length of time that the fireboxes last there is entirely different from what we have. Tubes on our road will only give us about 120,000 miles before they have to come out, that is to say, about a year's service at 10,000 miles a month. You can readily see that those conditions are entirely different from the conditions on a road where the tubes will last 10 and 11 years. So that I think that while the statement is acceptable that these engines are practicable and serviceable on lines like the Reading and Lehigh Valley roads, where there is an abundance of cheap fuel, and where good water is available, that it is quite consistent to find out in the West, where there is not the same abundance of cheap slack coal, and where water is exceedingly bad, that a different type of engine has to be used.

While we were disappointed with the Wootten firebox, as illustrated in this paper, our superintendents and others thought a modification of the box would be desirable, and with that in view, a recent engine, as described by Mr. Forsyth, has been designed, giving us about twice as much grate area as we had before.

Our experience with the Wootten box has been confirmed by the experience of other railroads in the West. A few years ago the Union Pacific built a number of Wootten firebox engines, perhaps 20. A couple of years ago when I was going over the Union Pacific shops, I found that they were getting rid of those engines just as fast as they conveniently could. They found the boxes very expensive to maintain, and I presume they could not at all times get enough slack to run them, and when they were obliged to use lump coal, the result from steaming was not satisfactory. So at the present time I think it doubtful if any of those engines are in successful operation on the Union Pacific.

Mr. W. H. Lewis (C., B. & N.).—We have had ample time to demonstrate the value of the Wootten principle, and so far as we have been able to learn, it is not a success, except perhaps in certain localities where they have a fuel suitable to it.

I think we must try and establish a happy medium between the work that the engine is expected to perform and the rate of combustion that the engine has got to have to make steam to do this work. Now, I believe that our late experience has demonstrated that there is a great deal more economy in high pressures that we are carrying at the present time than in anything else that we have sought to accomplish in locomotive construction. We cannot find any man who is ready to come forward and say that an excessively wide firebox is an advantage, but we do know that an excessively narrow one is a disadvantage where the character of the load is such that you can load your engines down to their maximum efficiency, and you find that to do this work you are burning out a firebox inside of two years (as is our experience). We must assume that the grate surface is too small and the rate of combustion is too rapid, and that it is necessary to get it a little larger. Now, how large shall we go? I am not willing to believe that it is necessary to go to the extent that some have advocated. I really think that when you get 45 sq. ft. of grate surface you have gone to the other extreme as compared with the 18.5 ft. that we now have, and there is a loss by the fact that it is impossible to distribute the coal over those large grates to get the best results for combustion of the coal.

Mr. David L. Barnes.—The success of the new Burlington engine with a large grate seems to settle pretty clearly the advantages of more grate surface. This engine has about 45 sq. ft. of grate, and is handled by the fireman without the least difficulty. If the increased area were obtained by an increase of length instead of width, no doubt there would be difficulty, and it would be impossible for the fireman to keep the grate covered properly; but with the increase of width, the fireman can reach all parts of the box, and if two doors are provided, the firing is easier than on any other class of locomotive, and even easier than with the deep firebox. With the deep box, when it is desirable to crowd the boiler very hard, it is not an easy matter to keep the grates properly cleaned and covered. This accounts for the wide variation in the efficiency of the same engine handled by different firemen with different degrees of expertness.

To say to-day that a small grate is as good as a large one is to take a position directly contrary to the facts. No steam engineer in any sort of steam plant work would make grates any smaller than is absolutely necessary, unless by doing so the area of the grate is increased to a point where the coal burnt per square foot per hour is less than 20 or 25 lbs. The single exception to this is in the case of locomotives, where the demand for power varies considerably. If the grates are made too large, there is a loss in descending grades and stopping at stations. For this reason grates on locomotives are made smaller than for any other class of steam service. The experiments made on ocean steamers show so conclusively that a high rate of combustion is accompanied by loss in efficiency, that it does not seem that any one conversant with the facts could dispute the value of a large grate.

In addition to the very large amount of experience in ocean steamers with widely different amounts of fuel burned per square foot of grate per hour, we have a great many experiments on locomotives in this country which show conclusively that locomotive boilers with large grates are more efficient than those with small grates, when boilers of equal shell diameter are doing the same work. Of course, if the shell diameters are the same, and the work is light, then the boiler with the small grate might be equally efficient.

It cannot be expected that a combustion of 200 lbs. per sq. ft. of grate can be maintained with the same draft as a less rate of combustion, and I think all agree that a strong draft reduces the efficiency when a boiler is so much forced as locomotive boilers are. In stationary boilers, where the draft is very light, an increase of the draft sometimes brings greater efficiency; but when the draft is increased to anything like locomotive draft, a further increase brings loss. The fact that large grates can burn the cheapest grades of fuel, and evaporate more water per pound of the cheap fuel than boilers with small grates can evaporate with high-class fuel, is of itself a substantial piece of evidence as to the value of the large grate area when it can be properly fired. It is not to be expected that any railroad company will pay two firemen on a locomotive, and any design of grate that calls for additional help, or for unusual exertion on the part of the firemen, will not be successful, nor will it be more economical than a small grate that can be properly handled and easily fired by one man.

I do not wish to be understood as saying that there are not in some cases good and sufficient reasons for the selection of a small grate area for a locomotive. Good reasons may be found in the conditions which prevail on some roads. But what I wish to emphasize is that, where the amount of fuel used per square foot of grate per hour is more than 150 lbs., the use of a larger grate will give a substantial saving. Particularly is this true with a comparatively poor quality of fuel such as is used on Western lines. In discussing a matter of this kind it is perhaps better to draw a sharp line between the efficiency per se of the locomotive and those practical conditions which may force the selection of a grate area different from that which will give the maximum efficiency. For instance, on some lines so much stress is laid upon duplication of locomotives and the maintenance of a standard type that a master mechanic may hesitate to select a larger grate area, even when he knows it would be more economical, owing to the fact that the larger area will generally carry with it some important changes in the details of construction, and interfere with the duplication. This duplication, however, is a matter foreign to the present discussion, which, as I understand it, relates solely to the efficiency of the larger grate.

The question of staybolts for large fireboxes is discussed by Mr. Barr in a manner that is gratifying. It is

a pleasure to hear an experienced railroad man say: "This matter of staybolt breakage, while it is troublesome and expensive, is not very serious, and we have manufactured a sentiment and made it one of the big bugaboos of railroading." This statement by Mr. Barr, coupled with another statement which he makes, that only 15 or 20 staybolts are renewed per boiler per year on this road, shows that he must have taken up the staybolt question in his usual thorough manner, and evolved a plan for making and putting them in, which is an improvement on the common plan. Probably he uses good material and cuts the thread with dies that are in proper shape, and puts the staybolts in with a small wrench and with only a reasonably tight fit in the sheet. There is nothing that will lead to so many broken staybolts as dull dies and tight fits. Dull dies indent the iron and act like a "jam" die of the kind that is often used to cut threads on small wires. A staybolt cut with a sharp-edged die will bend without breaking a good many more times than one cut with a dull or "jam" die. If there is a tight fit in the sheet the hard steel of the plate will indent the soft iron bolt and injure it so that it will not stand as much bending as one that is fitted less tightly. I have never heard of a loose staybolt breaking. A small degree of looseness permits the bolt to work a little in the sheet, and thus reduces the bending action and increases the life of the bolt in the same way that a ball joint will.

Mr. J. Snowden Bell.—In presenting the subject of wide fireboxes, it was my object, more particularly, to bring to the attention of our members the advantages of this type, as demonstrated in an extended period of service, and in over 1,100 locomotives, with anthracite fuel, believing, as I do, that advantages, similar in kind if not in degree, would be attained with the bituminous coal used in the West. My experience and observation with the latter fuel has been very limited, but, so far as it has gone, it has been to the above effect, and I had hoped that fuller and later data as to such use would be obtained from the N. Y., L. E. & W. R. R. A Wootten firebox was put on an old Baldwin passenger engine (the "Seagull"), on the Camden & Atlantic R. R., and gave such good results with bituminous coal that, after that road came into the possession of the Pennsylvania R. R. (which no one can charge with partiality to wide fireboxes), a new Wootten firebox was put on, and gave the same results, until the engine one day went into the ditch and was so badly battered up as not to be worth repairing, when the boiler was put in stationary service. The B. & O. R. R. also has an 18 × 24-in. passenger engine with Wootten firebox, which has made better time than any engine on their First Division, and burns bituminous coal as well as any narrow firebox on the road, steaming freer than any of them.

I am decidedly in favor of the wide firebox, but am not committed to any fixed width, nor to any special construction. It would seem that, for bituminous coal, it might be much narrower and shorter than the standare Wootten or the present wide fireboxes without combustion chambers, and while I am not prepared to fully agree with Mr. Gibbs that the firebox of the C., B. & Q. engine is "the best that has been brought out up to date," for Western coal, I believe that it is properly designed, has all the elements of success, and will so demonstrate in service. Mr. Barr's objection to large grates, on the ground that the average fireman cannot fire them properly, is, I think, applicable only to long grates, and this is the radical vice of the narrow firebox. In order to get enough grate area, they must be made too long for any man, either the regular fireman or a new one, to handle. This objection, in my opinion, also exists in several of the wide fireboxes, to which I have referred, and I believe they could have been made shorter, with advantage. The wide firebox makes up the area in width, and I have never seen any difficulty, in the East, in keeping its grates covered. There is no reason why there should be any with the smaller wide fireboxes, which would be sufficient with bituminous coal.

I may add that the Wootten boilers referred to by Mr. Rhodes were of antiquated type and imperfect design, and that the failure of those on the Union Pacific has been probably due to very bad water and want of applicability to the special kind of fuel employed.

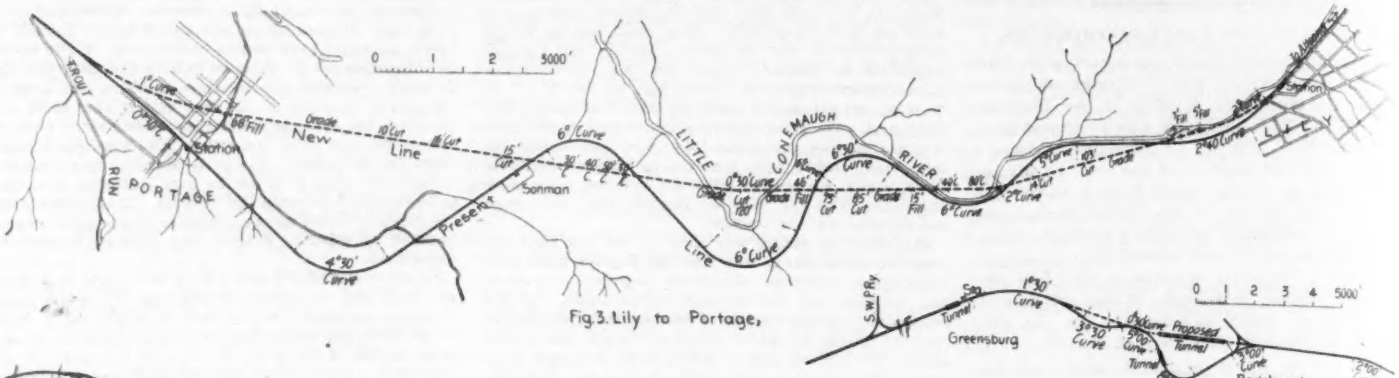


Fig. 3. Lily to Portage.

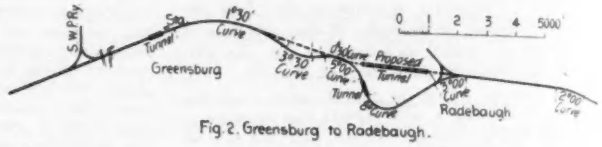


Fig. 2. Greensburg to Radebaugh.

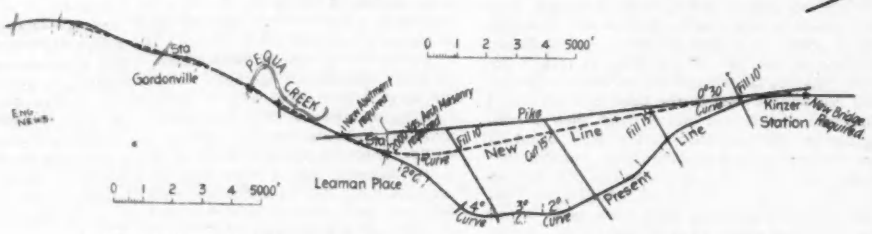


Fig. 4. W. of Gordonville to Leaman Place.

Fig. 5. Leaman Place to Kinzer.

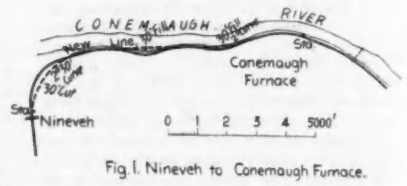


Fig. 1. Nineveh to Conemaugh Furnace.

CHANGES OF LINE ON THE PENNSYLVANIA R. R.

CHANGES OF LINE ON THE PENNSYLVANIA R. R.

The Pennsylvania R. R. is noted among American railway companies for the amount of labor and money which it has expended in improving the alinement of its road. The four plans which we publish this week show some new work of this kind which is to be done shortly, and contracts for the grading and masonry of which will be awarded Dec. 14, as noted by our advertising columns. We are indebted to Mr. Wm. H. Brown, M. Am. Soc. C. E., Chief Engineer, for blueprints from which our cuts have been prepared. The time for completing the work will be an important consideration in awarding the contracts.

1. Change of Line Between Conemaugh Furnace and Nineveh.—Fig. 1. This straightens the line along the bank of the Conemaugh River, and gives a much easier curve into Nineveh. This will save 0.6 mile in distance and 43° curvature. The same contract will include the straightening of the line at Radebaugh, involving the construction of a tunnel 2,100 ft. long, as shown in Fig. 2. This will save 0.2 mile in distance and 230° of curvature. This work is on the Pittsburg Division.

2. This is an entire change of line between Lily and Portage stations, on the Pittsburg Division, as shown in Fig. 3. The new line crosses the old line six times, and will save 1.11 miles in distance and 440° of curvature.

3. This is practically a new line from Kinzers to a point west of Gordonville, as shown in Figs. 4 and 5, and a new line west of Rheems station. The first will save 0.32 mile in distance and 146° of curvature, while the latter will save little in distance or curvature, but will reduce the maximum curve from 5° to 2°. Between Kinzers and Leaman Place there will be about 300,000 cu. yds. of excavation and 300,000 cu. yds. of embankment. This work is on the Philadelphia Division.

The grading will include all excavation and embankment for the roadbed, foundations, road crossings, etc. All cutting will be measured in the excavations, and estimated by the cubic yard under the following heads:

Earth will include clay, sand, loam, gravel and all other earthy matter, or earth containing loose stone or boulders not exceeding 3 cu. ft. in size.

Loose rock will include all stone and detached rock lying in separate and contiguous masses, containing not over 1 cu. yd., also all slate or other rock that can be quarried without blasting, although blasting may be occasionally resorted to.

Solid rock will include all rock occurring in masses exceeding 1 cu. yd., which cannot be removed without blasting.

The ground within lines 12 ft. beyond the slope-stakes, or 10 ft. beyond the berm ditch, where such ditch is required, must be cleared of all trees, brush and other perishable matter. Where the filling does not exceed 2½ ft. the trees, stumps and saplings must be grubbed; but under all other portions of the embankment it will be sufficient if they are cut close to the earth. All this work will be included in the price paid for excavation. Where grading is done for additional tracks the surface of the old embankment must be stepped off to prevent the slipping of the new material. In excavating and removing material from borrow pits, care must be taken to injure or disfigure the land as little as possible. No extra price will be paid for overhaul.

Bridge masonry will be founded upon solid rock or piles and grillage. The masonry will be rock-range work, in courses of not less than 12 ins., regularly decreasing from bottom to top of the pier or abutment. Headers and stretchers must be at least 4 ft. long, and all face stones will be laid in hydraulic cement mortar. The backing will be of large stones, laid dry, with every course grouted. The stones of ice-breakers and copings will be fastened together with iron clamps.

Arched culverts in soft material will have foundations of 8 to 12-in. squared timber laid side by side crosswise upon longitudinal sills, and where strong currents occur during floods, at least three courses of sheet piling will be placed across the foundation, one at each end and the others intermediate, the sheet piling being sunk at least 6 ft. below the top of the foundation timbers. The abutments will be of range work, and the arch stone laid in courses, with rubble spandrel backing.

Rectangular culverts of masonry will be built dry, with a waterway of not less than 2½ × 3 ft. The abutment walls must be at least 2 ft. thick, resting on a paving of 10-in. stone set edgewise, the ends of this paving being protected by curbing and broken stone. The covering will be of stone 12 ins. thick, lapping 10 ins. on each abutment wall.

All masonry work will have the face joints cleaned out, wetted and pointed.

EFFECTIVE CENTER OF LIGHT IN A STANDARD PHOTOMETRIC BURNER.*

By D. S. Jacobus, Hoboken, N. J.**

In tests of car lamps made by the department of tests of the Stevens Institute, it was necessary to employ a burner of about 6 c. p. as a standard of light. The burner selected was a Sugg Argand gas burner, size D, fitted with an opaque screen of the Edgerton pattern, which passed over a glass chimney. The opening for the emission of light was arranged so that the top and the lower part of the flame were obscured from view, as shown in Fig. 1; whereas the horizontal width of the slot was made greater than the diameter of the flame. The horizontal width, A B, of the slot was 1½ ins., and its height, C D, was 13-32 in. The diameter of the opaque screen was 1⅞ ins. The back of the screen opposite the slot was cut away so as to prevent reflected light from being thrown back and through the slot.

In this class of a screen and burner, the distances employed in calculating candle-power measurements are often measured to the geometrical center of the flame. Any error so involved will be a small one, if the illuminated disk of the photometer is used at a considerable distance from the burner, and in about the same position which it occupied when the burner was calibrated by means of candles. In our tests, however, the burner had to be used in positions near to, as well as far away from the disk; so that it was necessary to determine the effective center of the light which it emitted.

The method of determining the effective center was as follows: The photometer disk was set at A_1, in

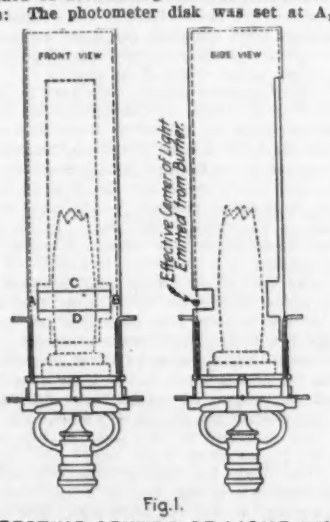


Fig.1.

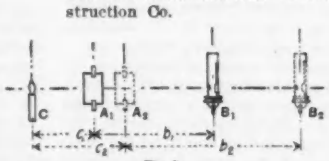


Fig.2.

THE EFFECTIVE CENTER OF LIGHT EMITTED FROM A STANDARD PHOTOMETRIC BURNER.

Fig. 2, at a distance, c_1 from the candles, C, and the standard burner was brought to a position, B_1, at which there was an equal illumination on the two sides of the photometer disk A_1. The distance, b_1, from the disk to the geometrical center of the burner was then recorded. The disk was then moved to another position, A_2, at the distance c_2 from the candles, and the corresponding distance, b_2, from the disk to the burner was recorded. The disk was then set back to its first position at A_1, and a second reading of b_1 obtained. It was then moved to A_2, and then back to A_1, and so on until a number of readings of b_1 and b_2 were obtained. After a sufficient number of readings was taken to eliminate any irregularity due to variations of light emitted from the candles, the results were averaged and the distance, x, of the effective light center from the geometrical center of the flame was found by means of the formula:

$$x = b_1 - \frac{b_2 - b_1}{\frac{c_2}{c_1} - 1}$$

The results of the experiments show that the effective light center of the burner was about 0.9 in. from the geometrical center of the flame and entirely outside the flame, as indicated in Fig. 1.

The error involved, if all measurements were made from the axis of the burner instead of the effective center, both in calibrating and in using the standard burners would have been as a maximum about 10% in the lamp tests which we made. In these the effective center of the burner was placed at a distance of 60 ins. from two standard candles in calibrating the burner, and the minimum distance at which the burner, when used as a standard, was placed from the photometer disk was about 12 ins.

*Abstract of a paper presented at the New York meeting of the American Society of Mechanical Engineers.

**Assistant Professor Experimental Mechanics, Stevens Institue, Hoboken, N. J.

The engineering work of the Lake Erie & Ohio River ship canal survey is about completed, and Chief Engineer George M. Lehman is preparing his report for submission to Col. John M. Roberts, Chairman of the Engineering Committee. The plans will then be presented to the consulting engineers, Gen. H. L. Abbot, Mr. N. H. Hutton and Prof. L. M. Haupt.

A survey of the state canals of New York is to be at once commenced by State Engineer C. W. Adams, with reference to carrying out the proposed improvements under the $9,000,000 appropriation. At least $1,000,000 could be usefully expended in the first year. An endeavor will be made to have the time for advertising each contract reduced from six weeks to two weeks, by the passage of a special bill, in order to hasten the work. An engineering party will be put to work at once on each 15-mile division.

The state canals of New York carried 3,467,848 tons of freight up to Dec. 1, when navigation closed. The traffic for 1894 was 3,882,560 tons, showing a loss of 414,712 tons in the year 1895. Considering trade conditions and low railway rates, the users of the canal are said to regard this showing as quite favorable.

The Maritime Canal Co., of Nicaragua, reports as follows to the Secretary of the Interior, Hon. Hoke Smith: Total cash received since the organization of the company, from the sale of 10,145 shares of capital stock and from other sources, $1,109,880.81. It has paid out for property, labor and materials in construction and administration expenses, $1,109,522.25, and 31,990 shares of full-paid stock of the value of $3,199,000, and is obligated for $6,855,000 of its first mortgage bonds. It has also issued 180,000 shares of its capital stock, of the par value of $18,000,000, in payment of concessionary rights, franchises and other property. Of the amount first named $225,000 is a claim against the Nicaragua Canal Construction Co. for advances for equipment, in liquidation of which the Maritime Canal Co. holds obligations representing $518,500 of its first mortgage bonds and 2,420 shares of its capital stock. The outstanding cash liabilities do not exceed $50,000. The assets consist of its unissued capital stock, the $518,500 bonds, the 2,420 shares of stock, and the concessions, franchises, plant, railways, lands, buildings, telegraph lines, locomotives, cars, etc., in Nicaragua, purchased at a cost of $50,000 from the Government of Nicaragua. Work on the canal was entirely suspended in August, 1893, by reason of the financial embarrassment of the Nicaragua Canal Construction Co.

The dynamite guns recently tested at the Presidio Reservation, near San Francisco, threw four rounds of shells, each containing 100 lbs. of dynamite, a distance of 5,000 yds. Five rounds of projectiles, each weighing 1,140 lbs. were loaded and fired in 8 min. 23 sec. The board of examiners report that the guns exceeded their requirements in every test.

A new project for a municipal building in New York city is included in the late report of a sub-committee of the Board of Estimates and Apportionment. They recommend the removal of the old brown-stone court house, the engine house and the Hall of Records, now occupying 21,000 sq. ft. in the northeast corner of the City Hall Park, and replacing these by a new fireproof building, large enough to accommodate the offices removed, and to include two court rooms for the use of the Surrogate and Department of Taxes. The report finds the old buildings badly lighted and ventilated, inadequate for present purposes, and the records are in danger from fire.

The Beach Pneumatic Tube Co. was formed in 1868 for the purpose of laying and operating a system of pneumatic tubes for the conveyance of baggage and parcels under the streets of New York. A section of this tube was actually built in 1870, between Park Place and Murray St., and a passenger car was run through it for exhibition purposes. The tunnel was built with a hydraulic shield. As the company's franchise did not authorize passenger traffic, work was stopped. This same company was reorganized as the Broadway Underground Railway Co., and in 1886 it became the New York Arcade Ry. Co. But no franchise for transporting passengers could be secured. It is now rumored that a syndicate is being formed to construct and operate a line, on the original franchise, for the rapid transit of letters, packages and baggage, and the Legislature is to be asked for the requisite further authority.

An insurance war is being carried on in some of the newspapers between the respective advocates of the mutual and the stock companies. An article has been written by Mr. Edward Atkinson attacking the stock companies, and representatives of the latter are making vigorous replies. It appears that the mutual companies, like those of which Mr. Atkinson is at the head, have for many years been educating the public to the knowledge of the fact that cheap insurance can only be had by safe construction and proper fire protection. Now that the most important mills are well built and well protected, the actual fire risk can be safely insured at a very low figure, and the stock companies are ready to take advantage of this improved condition, which they had no hand in creating. The method adopted by the stock companies is shown in the following extract from a letter in the New York "Journal of Commerce":

The stock companies have devised a plan to handle these large risks through a syndicate, thus reducing expenses to a minimum, and doing away with the annoyance to property owners of numerous inspections by each company, and are also willing to accept a small profit. It is probable that the mutual system has received a blow that it will be hard to recover from, for the tendency will be for the best risks to get the low rates of the Factory Insurance Association, leaving the poor and unprofitable mills in the mutuals, thus cutting down or annihilating the mutual dividends.

Any property owner would rather pay the stock companies a fair rate, say, 25 cts., equal to $2.50 for $1,000 of insurance, and get the policies of a syndicate of 30 stock companies, having cash assets aggregating over $100,000,000, than to rely on the security of mutual companies that have comparatively but little back of their policies other than notes or contingent liabilities of policy-holders, many of whom will, being human, decline to pay up in case there is need, and who cannot be forced to.

Forest preservation and irrigation are important topics in the annual report of Hon. Hoke Smith, Secretary of the Interior. Under the act of March 3, 1891, 17,000,000 acres of land have been included in the forest reserves, protecting the headwaters of many of the streams used for irrigating. But the present force is inadequate to protect these reservations from the depredations of timber cutters. There are but 30 special agents to protect the timber upon the public domain, to examine swamp lands, and to investigate fraudulent land entries, and it is not strange that the Secretary asks Congress to devise some plan for adequate protection, either by the army or by a corps of foresters and assistants. This legislation is absolutely necessary for the conservation of the rainfall and its utilization in irrigation.

The delta of the Mississippi is sinking at the rate of about 1 ft. in 15 years, according to late tide-gage observations made by Major Quinn, of the U. S. Engineer Corps. These gages were placed in position in 1875, and verified in 1877. Up to 1890 the gage showed a sinking of 1 ft., but during the last five years it remained nearly stationary. The New Orleans "Picayune" figures out that as the city of New Orleans is now only about 16 ft. above sea-level, if the gradual sinking continues at the rate fixed in 1875-90, the city would disappear under the water in about 200 years. But the investigation seems to show a spasmodic condition of affairs, without regularity, and before the two centuries elapse, other natural conditions may tend to reverse the operation, and raise the land alluvially.

The Engineer officers of the U. S. Navy, in the Navy Personnel bill to be presented to this Congress, will adhere to the demand for positive instead of relative rank. They will insist upon the control of the enlisted force of the corps, subordinate only to the captain of the ship; and in this way propose to do away with the present possible incongruity of a naval cadet having higher authority than an old Engineer officer in the control of mechanics, firemen, oilers and other members of the engineer force. An increase in the Engineer corps is to be asked for, and it is proposed to increase the cadetship in the Engineer Division at the Naval Academy by permitting each Senator to appoint one such cadet. Graduates of technical schools may also be allowed, under certain conditions, to enter into competitive examination with the Engineer cadets, after a special six-months' course of instruction at the academy. This competition would be to fill existing vacancies in the Engineer corps.

A piece of 6-in. cast iron water pipe, laid in 1822, was recently examined by Mr. John C. Trautwine, Jr., Chief Engineer of the Water Bureau of Philadelphia. He found the thickness of the iron about the same as when laid, the outside showing little effect from rust, though the pipe was not dipped in any preservative compound before laying. The inside, however, was incrusted with a compound of oxide of iron and graphite, which occupied about one-fifth of the total cross-section of the pipe. Practically no incrustation was found in a pipe laid in 1874; but this pipe had been coated inside and out before laying.

The U. S. patents on the Lee magazine rifle, which has been adopted as the small arm for the navy, have been purchased by the Winchester Arms Co., of New Haven, which company is also the contractor for supplying the guns to the government.

ANNUAL MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The proceedings at the Tuesday evening and Wednesday morning sessions of this Society were reported in last week's issue. On Wednesday evening, the first paper presented was that of Dr. C. E. Emery, entitled "Means Adopted for Saving Oil in a Large Oil Refinery." We gave an abstract of this paper last week. A brisk discussion followed, those taking part generally agreeing in considering the common direct-acting small steam pump as one of the most wasteful of all steam appliances, and in recommending the use of power pumps driven by belt from the main engine, or by electric current when the pump is located at a great distance from the engine. The next paper was on the "Reliability of Throttling Calorimeters," by Prof. J. E. Denton, an abstract of which was also given in last week's issue. This was followed by another paper on the same subject, entitled "Some Experiments with the Throttling Calorimeter," by Aug. A. Goubert and E. H. Peabody. A brief abstract is as follows:

It is usually assumed that the correct sample of steam once obtained, the throttling calorimeter will give an accurate reading of its condition. That this is not the case with the accepted mode of using the instrument, experiments made by the authors seem to demonstrate. They have found the determination of the amount of moisture in steam, even by the most approved methods, exceedingly unsatisfactory.

Three calorimeters were used, all of the same construction. Two of them were made practically alike, and connected with open-ended nipples directly opposite each other in the vertical portion of the steam main on top of the boiler. The third calorimeter was connected closer to the boiler drum, but with a longer and somewhat crooked arrangement of piping. The orifices of throttling diaphragms were 1-16 in. diameter.

The thermometers showed considerable discrepancies in their readings throughout a series of tests made under a variety of conditions. The readings are plotted on diagrams, showing the irregularity of the observations, but the authors in their paper neglect to give any figures of percentages of moisture calculated from the observations, and the reader, therefore, is unable to judge whether or not the discrepancies in results have any serious magnitude.

The two papers on calorimeters led to considerable discussion, the general view being that the throttling calorimeter itself is a very reliable instrument, when proper precautions are taken in its use, such as calibrating the thermometers and correcting for the errors due to taking temperature from shallow mercury wells, the stem of the thermometer being exposed; but that the instrument is of no use whatever to determine the amount of moisture flowing from a boiler or along a steam pipe when the attempt is made to take a small sample out of this pipe by a perforated nozzle. Enormous exaggerations of the actual amount of moisture are possible, as was pointed out in Professor Denton's paper, and the only correct way to determine the moisture in steam, except that of condensing the whole of it, is to pass it all through a good steam separator, which will take out all of the moisture except less than ½%, and use the throttling calorimeter beyond the separator as an indicator to determine whether or not the latter has properly done its work. The question was asked, "What is commercially dry steam?" and the answer given was that steam containing less than 3% of moisture should be considered commercially dry, and that it would be a great boon to engineers and boiler experts if the refinement of attempting to determine the moisture down to ¼% or less were done away with.

The next paper was by Dr. Emery, on "Comparative Tests of Steam Boilers with Different Kinds of Coal." An abstract of this paper is given on another page in this issue. The discussion which followed took up the remainder of the session, and was continued at the session of Thursday morning. The question whether a boiler should be rated after testing by its "efficiency" as compared with the heating value of the coal used in the test, instead of by the ordinary method of "equivalent evaporation from and at 212° F. per pound of combustible," is still in dispute, and it, with Dr. Emery's paper, will be studied and reported on by the Committee on a Standard Code for Boiler Tests.

On Thursday morning the first paper taken up was entitled "Experiments on the Friction of Screws," by Albert Kingsbury. The following is an abstract:

The writer has made several hundred experiments on the friction of metallic screw threads under the conditions of very slow motion, free lubrication, and pressures varying from zero to 14,000 lbs. per sq. in. of bearing surface.

The results sought were the minimum and the mean coefficients of friction under these conditions. No attempt was made to find a maximum coefficient; this would require trials without lubricants, and with rough surfaces. The maxima obtained under the given conditions were noted, however.

The tests were made upon a set of square-threaded screws and nuts of the following dimensions: Outside diameter of screw, 1.426 ins.; inside diameter of nut, 1.278 ins.; "mean diameter" of thread, 1.352 ins.; pitch of thread, ⅛ in.; depth of nut, 1 1-16 in. (effective). This depth of nut makes the area of thread approximately 1 sq. in.

The nuts fit the screws loosely, so that all friction is excluded, except that on the faces of the threads directly supporting the load. The threads had been worn to good conditions by previous trials.

The machine used for the experiments was designed for the purpose. It was built in the New Hampshire college shops in 1891-92, and now forms part of the laboratory equipment of the college.

The screws and nuts used in the test were as follows: Screws, mild steel, common wrought iron, cast iron, cast bronze, mild steel (case hardened). Nuts, mild steel, common wrought iron, cast iron, cast brass.

The conclusions which the results seem to warrant are:

That for metallic screws in good condition, turning at extremely slow speeds, under any pressure up to 14,000 lbs. per sq. in. of bearing surface, and freely lubricated before application of the pressure, the following coefficients of friction may be used:

Coefficients of Friction.

Lubricant.	Min.	Max.	Mean.
Lard oil	.09	.25	.11
Heavy machinery oil (mineral)	.11	.19	.143
" " " and graphite, in equal volumes	.03	.15	.07

The writer does not consider that the tests prove that any one of the metals used develops less friction than any of the others, under the methods of testing employed, although such results might be inferred from one set of the tests, for instance, in which the coefficients for the brass nut are uniformly lower than for any of the others. Nor does he believe that the method of testing employed is the best possible; a number of cast iron nuts and screws tested by themselves, and a number of steel nuts and screws similarly tested, might give results showing less variation than is evident in the records given above, and hence more definitely comparable with each other.

This paper was highly commended as being an important contribution to our knowledge of the friction of screws, the existing literature upon which is very meager. In response to a question, Which of these coefficients given in the paper should be used in designing? the author replied that in determining the average power to be used in driving the screw, 15% would be about right, the maximum coefficient given with oil and graphite lubrication, for determining strength of parts of the mechanism, 30% should be used, for occasionally the screw might be imperfectly lubricated; while if a screw were to be designed which would not "overhaul" or run backward under any load, a coefficient as small as 7 or 8% should be taken, to provide for the contingency of exceptionally good lubrication. Concerning the use of graphite, with oil as a lubricant, much difference of opinion was shown. For occasional work, under very heavy pressures, it was stated that it might be recommended, but for continuous regular lubrication of shafts it was condemned, on account of its being impossible to permanently suspend it in oil, while, if suspended temporarily, its viscosity would be objectionable.

The next paper was entitled "Tests of a 10-HP. De Laval Steam Turbine," by Prof. W. F. M. Goss. An abstract of this paper was given last week.

It was followed by a brief paper describing a recording device for testing machine, by G. W. Bissell. The device described in this paper is a rotating drum attached to the frame of a 50,000-lb. screw-power testing machine at a point below the outer end of the moving scale beam. Rotation of the drum is proportional to the weight applied, and a pencil moves across the paper, being actuated by a lever attached to the pulling head of the machine. Automatic diagrams were given in the paper showing the results obtained by putting a ¾-in. spiral punch through plates of wrought iron. The device, as at present constructed, appears to be applicable only to those tests—such as punching and transverse tests—in which the movement of the movable head of the testing machine may be taken without gross error, as equal to the deformation of the test piece. This is, of course, not the case in tension tests.

Thursday afternoon was spent by the members in various excursions. The principal one, participated in by about 40 members, was to the works of the Pond Machine Tool Co., at Plainfield, N. J. It was conducted by Mr. Charles A. Moore, of the firm of Manning, Maxwell & Moore, which firm own a controlling interest in the Pond Co. Plainfield is about 25 miles from New York, on the line of the Central Railroad of New Jersey. The works occupy a narrow strip of ground, 3,000 ft. long, adjoining the railway. The principal building is a machine shop, of modern construction, 700×100 ft., served with three Shaw electric traveling cranes. The regular work of the concern is the making of machine tools of the heaviest description, but for some years it has been engaged in government contracts for equipment of the gun shops at Washington and at the Watervliet, N. Y., arsenal. The contracts amounted to $1,780,000. The most interesting thing seen at the works was an immense gun lathe for finishing 16-in. guns. This is the 35th lathe that has been furnished by the company to the government, and is the largest lathe that has ever been made in this country, and probably in the world. It is intended for turning and boring the largest gun which the government expects to make for its coast defenses—a nickel steel 16-in. 150-ton gun. The largest gun to be carried on board ship is 13 ins. The dimensions of the lathe are as follows: Total length of bed, 135 ft., of which the headstock occupies 12 ft., the boring bar carriage, 67 ft., leaving 56 ft. available for the gun. The swing is 110 ins. The face plate is fitted with eight steel jaws, with adjustable screws, with a range capable of taking in pieces from 6½ to 44 ins. diameter. The gun being gripped in these jaws, either by its breech or its muzzle, it is carried by [illegible] back rests of special design. The head stock is double back geared, the largest step of the cone being [illegible] diameter, of a width suitable for a 10-in. belt. The [illegible] drives the face plate through gearing giving 390 revolutions of the cone to one of the face plate. The face plate gear is a steel casting, 11 ins. face, 3½ ins. circular pitch. The bearing of the main spindle is 24 ins. diameter by 36 ins. long. The journal boxes are of hard bronze. The lathe is fitted with two tool carriages, each carriage capable of carrying two or four tools independently, and each can be fed independently of the other in any direction, forward or back, out or in, or at any angle. The feed for the tool carriages is obtained by a screw 6 ins. diameter, 66 ft. long, and a splined shaft, 4 ft. diameter, 70 ft. long, carried on drop bearings between the first and second tracks of the bed. The feed for the boring bar is obtained from the head stock, and transmitted to the rear end of the boring bar the whole length of the lathe by means of a 4½-in. splined shaft, 137 ft. long, carried by drop bearings inside of the bed, near the third track of the lathe. This shaft is made in two pieces, for convenience in transportation. The feeds for the tool carriages vary from .02 in. to 3 ins., and the feeds for the boring bar from 0.008 in. to 0.17 in. per revolution of the gun. The weight of the breech of the gun is carried in a very large bronze shoe, and the remainder by two back rests fitted with a ring which revolves with the gun, the gun being centered in the ring by from 6 to 12 adjustable jaws.

The event of Thursday evening was a reception and conversazione at Delmonico's. The elegant ball-room and parlors were crowded, the great number of ladies present being especially noteworthy. This was the only distinctively social event of the meeting.

On Friday morning papers were read by Prof. R. C. Carpenter on the "Effect of Temperature on the Strength of Wrought Iron and Steel;" by Prof. D. S. Jacobus on an "Experimental Method of Determining the Effective Center of the Light Emitted from a Standard Photometric Burner," and by Prof. John H. Barr on the "Proportions of High-Speed Engines." Abstracts of these papers appear elsewhere in this issue. In the discussion, the last-named paper was especially commended as a good beginning in a research which is to be continued, in the endeavor to obtain rational formulas with constants, which have some better basis than guesswork, which is now largely used in engine and machine designing. Mr. P. M. Chamberlain presented a paper entitled "Some Data Relating to Forge Shop Design," describing the arrangement of the forge shop of the mechanical department of the Michigan Agricultural College. The floor of the shop is 30×40 ft. The forges, 20 in all, are arranged in two rows of five pairs each. Hoods are placed about 6 ins. above the top of each forge. The smoke flue leading from each pair of hoods is of galvanized iron, No. 20 gage, 5 ins. diameter, gradually enlarging towards the main pipe. The latter is located under the floor, instead of overhead, as is the usual practice. An exhaust fan, 15 ins. diameter, is placed in a vertical pipe leading from the outer end of the main. A blower, 6 ins. diameter, supplies the blast for the forges. In the discussion of this paper, while the common blacksmith's forge adopted in the design was commended as suitable for the purpose of a school, for intermittent use it was condemned as being behind the age for practical continuous work, where a forge built of firebrick, with a firebrick roof, is much better, both for heating uniformly and for saving fuel.

The closing proceedings of the meeting consisted of a series of pleasant surprises. The first was the reception of a gift from Miss Louisa Lee Schuyler, of Gramercy Park, New York city, of the original drawing by Robert Fulton of his steamboat called the "Fulton," which ran on Long Island Sound. The drawing is dated March 1, 1813, and is handsomely framed. It was for many years a prized possession of Miss Schuyler's father. A suitable set of resolutions was passed accepting the gift. The next surprise was the announcement by Professor Hutton that he had purchased for the Society a fine oil portrait of Capt. John Ericsson, painted in 1862, the year when his "Monitor" raised him to the pinnacle of his fame. The portrait was dicovered by a curio hunter in the rooms of a dealer in old bric-a-brac, on First Avenue, New York city, covered with dust, and with its frame damaged. The dealer could not tell where the picture had come from, and he let Professor Hutton have it for $25. After the portrait had been exhibited, Mr. A. H. Raynal, an old friend of Captain Ericsson's, presented to the Society a copy of the volume describing Ericsson's inventions up to 1876, which the illustrious inventor had privately printed and exhibited at the Centennial Exhibition. The thanks of the Society having been given to Professor Hutton and to Mr. Raynal, the meeting adjourned. It was one of the best attended and most interesting ever held by the Society. By Thursday evening over 400 members and guests had signed the register of attendance.

CONTENTS OF SUPPLEMENT.

PERSONALS..... 189
ENGINEERING SOCIETIES..... 189
Coming Technical Meetings..... 190
NEW PUBLICATIONS..... 190
CONSTRUCTION NEWS:
List of Contracts Pending..... 190
Railways..... 190
Street and Electric Railways..... 191
Electric Light and Power..... 191
Bridges..... 192
Buildings..... 192
Water-Works..... 193
Irrigation..... 194
Sewerage..... 194
Garbage Disposal..... 194
Streets and Roads..... 194
Manufacturing Plants..... 195
Miscellaneous Contracts and Supplies..... 195
Contract Prices..... 196
INDUSTRIAL NOTES..... 196

PERSONALS.

(Readers are requested to contribute items of interest for publication in this column.)

Mr. J. J. Weaver has been elected City Engineer of Ludlow, Ky.

Mr. N. D. R. Allen is the newly-elected County Surveyor of Baltimore county, Md.

Mr. Wm. A. Veach has been appointed receiver of the Water-Works Co. at Newark, O.

Mr. Edward R. Reveley has been appointed Superintendent of Water-Works at Cornwall, N. Y.

Mr. J. M. Coe, President of the Lima Locomotive & Machine Works, died at Lima, O., on Nov. 30.

Mr. E. L. Brown, a consulting engineer at Brockton, Mass., has opened a branch office at Whitman, Mass.

Mr. E. H. Keating, City Engineer of Toronto, Ont., sailed on Nov. 27 for Europe, to be absent two months.

Mr. M. J. Coyle has been appointed Superintendent of the Hudson Boulevard by the Board of Freeholders of Jersey City, N. J.

Mr. F. I. Chafee, a member of the firm of Chafee, Lyons & Gamino, sewer contractors, died at Providence, R. I., on Nov. 29.

Mr. Wm. G. Nellson has resigned his position of Acting Manager of the Taylor Iron & Steel Co., of High Bridge, N. J.

Mr. Hugh Quigley, a contractor, of Baltimore, Md., the builder of many large warehouses and residences in that city, died on Dec 1.

Mr. S. B. Fisher has received the appointment of Assistant Chief Engineer of the Missouri, Kansas & Texas Ry., with headquarters at Parsons, Kan.

Mr. Theodore D. Osmun, Superintendent of Sewers at Newark, N. J., died suddenly at Newark, on Dec. 5. He was in the service of the city of Newark for 15 years.

Maj. W. F. Hancock, Corps of Engineers, U. S. A., has been appointed to serve on the Ohio River and Lake Erie Canal Board, succeeding Gen. O. M. Poe, deceased.

Mr. Charles A. Hague, M. Am. Soc. M. E., has opened an office as consulting engineer at 39 Cortlandt St., New York, still retaining, however, his connection with Henry R. Worthington.

Maj. J G. D. Knight, Corps of Engineers, U. S. A., has been detailed a member of the Board of Engineers at New York. He will continue also his duties in charge of the Willet's Point School.

Mr. Frank J. Sloat, formerly Superintendent of the Sandusky City R. R. Co., of Sandusky, O., has been appointed Superintendent of the Akron, Bedford & Cleveland R. R. Co., Akron, O.

Hon. Andrew Cowan, a member of the Board of Park Commissioners, of Louisville, Ky., has retired, his term of office having ended. The new board has organized with Col. John B. Castleman as President.

Mr. F. O. Rusling has been transferred from the superintendency of the Buffalo Ry. Co. to the general managership of the Rochester street railway lines, these companies being controlled by the same interests.

Mr. W. C. Squire, formerly Mechanical Engineer of the Frost Carbureter Co., and later Mechanical Editor of the "Railway Age," has been appointed Mechanical Engineer of the Sheffield Car Co., at Three Rivers, Mich.

Mr. T. A. Mackinnon now holds the position of First Vice-President of the Boston & Maine Ry. Co., as well as that of General Manager. Mr. W. F. Berry has been appointed to the newly-created office of Second Vice-President.

Mr. D. B. Smith, assistant to Col. J. H. Hampson, who has secured the contract for extending the Mexican Central Ry., has arrived at Guadalajara, Mex., with an extensive grading outfit, and will commence work immediately.

Prof. F. J. Stanton, of Cheyenne, Wyo., has received the appointment of Chief Engineer of the Colorado, Utah & Wyoming Ry. Co., which proposes to build from Rawlins, Wyo., to Sulphur Springs, Colo., and Ashley, Utah.

Mr. Geo. A. Ricker has been appointed Chief Engineer of the Buffalo Traction Co., a new street railway corporation, proposing to build in the city of Buffalo 66 miles of electric railway, or about 120 miles of track.

Prof. L. G. Carpenter, of the Colorado Agricultural College, has been decorated by the French Government for his researches in connection with irrigation and irrigation engineering, being made Chevalier in the order of Merite Agricola.

Mr. H. C. Ashenfelter, contractor for the building of the State University nearing completion at Seattle, Wash., met his death by suffocation on Dec. 3, in an attempt to extinguish a fire in the structure of which he was in charge.

Messrs. John F. Anderson and Cary C. Barr, contractors, of Jersey City, N. J., have dissolved partnership. Mr. Anderson will continue the contracting business in Jersey City, and Mr. Barr will go to Streator, Ill., where he will conduct the clay business formerly owned by the firm.

Mr. Henry W. Coddington, a builder and contractor of Kalamazoo, Mich., died on Dec. 1, aged 67 years. Mr. Coddington filled many large contracts throughout the state, among them churches in Ann Arbor, Muskegon, Marquette, and other cities, and a number of important buildings in Kalamazoo.

Capt. Henry H. Tatem, Secretary and Treasurer of the Cincinnati, New Orleans & Texas Pacific Division of the Queen & Crescent system, died on Dec. 1, at Cincinnati. Mr. Tatem began his railway career with the Cincinnati Southern in 1869, and since that time has been connected with the Queen & Crescent system in various capacities.

Mrs. Emeline Westinghouse, the widow of George Westinghouse, Sr., died in New York Dec. 10 at the age of 86. Mrs. Westinghouse was married in 1828. She was the mother of 10 children, of whom only two are now living, George and Herman, who have followed in their father's footsteps as inventors, and have built up the vast enterprises bearing their name, which have made the family name known all over the world.

Mr. Alphouse Fteley, M. Am. Soc. C. E., Chief Engineer of the New York Aqueduct Commission, and Mr. Desmond Fitz-Gerald, Vice-President, Am. Soc. C. E., have been selected to serve on a board of expert engineers to consider and propose a method for increasing the water supply of Washington, D. C. The board was appointed by General Craighill, Chief of Engineers, U. S. A., and comprises, in addition to the two civilian members above named, Maj. W. L. Marshall and Capt. J. L. Lusk, Corps of Engineers, U. S. A.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Dec. 11. Quarterly meeting at Boston, Mass. "Operation of a Pumping Plant by Electricity," by Chas. A. Hague. Secy., J. C. Whitney, Newton, Mass.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 13. Secy., D. W. Meeker, St. Paul, Minn.
INDIANAPOLIS ENGINEERING CLUB.
Dec. 14. Secy., C. C. Brown.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Dec. 14. Secy., Forrest J. Smith, Denver Block, Helena.
ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 16. Secy., E. Nexson, Kasota Block.
WESTERN RAILWAY CLUB.
Dec. 17. Secy., W. D. Crosman, Rookery Bldg., Chicago.
COLUMBIAN ENGINEERING SOCIETY.
Dec. 17. Secy., W. F. Hart, University Bldg., 15th and H Sts. N. W., Washington, D. C.
ENGINEERS' CLUB OF ST. LOUIS.
Dec. 18. Secy., W. H. Bryan, Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 18. "An International Metric Gage" by Thomas Egleston, and "Asphalt Reservoir Linings," by Rudolph Hering. Secy., C. W. Hunt, 127 E. 23d St., New York.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 18. Secy., F. Van Vleck, Los Angeles, Cal.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Dec. 18. Secy., J. A. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 18. Secy., S. E. Tinkham, City Hall.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Dec. 18. Secy., R. W. Pope, 26 Cortlandt St., New York.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 19. Secy., C. H. McLeod, Montreal.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Dec. 19. Secy., D. Carhart, Carnegie Library, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Dec. 19. Secy., J. F. Wilson, Odd Fellows' Temple.
NEW YORK RAILROAD CLUB.
Dec. 19. Secy., John A. Hill, 25d Broadway, New York.
ENGINEERS' CLUB OF COLUMBUS, O.
Dec. 21. Secy., David Buel.
ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 21. Secy., L. F. Rondinella, 1122 Girard St.
WISCONSIN POLYTECHNIC SOCIETY.
Dec. 24. Secy. W. K. Means, Loan & Trust Bldg., Milwaukee.
ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 26. Secy., Lucius P. Brown, Nashville, Tenn.
WESTERN SOCIETY OF ENGINEERS.
Jan. 1. Secy., Chas. J. Roney, Monadnock Block, Chicago.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 3. Secy., O. H. Von Geldern, 819 Market St., San Francisco.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 6. Secy., G. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
Jan. 6. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Jan. 9. Secy., Jas. K. Zollinger, Norton Building.
CENTRAL RAILWAY CLUB.
Jan. 10. Secy., H. D. Vought, "Courier" Office, Buffalo, N.Y.
ENGINEERS' CLUB OF KANSAS CITY.
Jan. 13. Secy., F. W. Tuttle, Baird Building.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Jan. 14. Secy., F. A. Colburn, Case Library Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Jan. 14. Secy., H. Breen, 30 Jacobson Block.
NORTHWEST RAILWAY CLUB.
Jan. 14. Secy., G. A. Seley, 80 Metropolitan Block, St. Paul, Minn.
NORTHWESTERN SOCIETY OF ENGINEERS.
Jan. 14. D. W. McMorris, Burke Bldg., Seattle, Wash.
NEW ENGLAND RAILROAD CLUB.
Jan. 15. Secy., F. M. Curtis, P.O. Box 1576, Boston, Mass.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Jan. 16. Secy., F. A. Charplot, Macon, Ga.

WESTERN SOCIETY OF ENGINEERS.—At a meeting of the Society, held Dec. 4, Mr. Clement F. Street gave an informal talk on the engineering characteristics of the railways of Oriental countries, from observations made in his trip around the world as engineer of the commission sent out by the railway department of the Field Columbian Museum of Chicago.

NEW JERSEY SANITARY ASSOCIATION.—The 21st annual meeting of the Association was held at Atlantic City, N. J., Dec. 6 and 7. An unusually large number of papers of engineering interest were presented, besides a number of others pertaining to other branches of the work of health boards and hygienists.

Mr. Carrol Ph. Bassett, M. Am. Soc. C. E., read a paper on "Governmental Methods for Preventing the Pollution of Streams." Individual and corporate property, he stated, is protected by all the ingenuity of the law, but common public property is not so well guarded, as is shown by the deforesting of gathering grounds for water and the pollution of streams. If streams are to be kept pure, public control is necessary. New Jersey legislation on this subject is wofully deficient. All the important suits brought in the interests of health for the prevention of stream pollution have failed.

As New Jersey laws now stand, the courts settle questions of stream pollution on so-called expert testimony in courts, much of which is bogus. The judges know nothing of the subject. Yet decisions rest with them, instead of with scientific boards. Massachusetts practice was cited as showing the beneficent results of intelligent and well-directed efforts by state authorities to preserve the purity of streams. The need for similar powers on the part of the New Jersey Board of Health, or some other proper body, was made evident. The paper was a very timely one, owing to the efforts now being made to prevent the further pollution of the Passaic River, the danger that other streams of the state will eventually become as bad, and the unsatisfactory laws now on the statute books.

Mr. Percy Jackson, speaking as a lawyer, said that until recently it has been held in New Jersey that streams are the natural outlets of sewers. New Jersey now stands where England did early in the centtury, a fact which is largely due to the ignorance of the general public regarding these matters, since public opinion has a great influence upon judges, as it also has on legislatures.

"Artesian Sources of Public Water Supplies in New Jersey," by State Geologist J. C. Smock, described artesian conditions and the development of wells in the state.

In connection with a discussion of school hygiene, it was asserted that there are only three or four schoolhouses in New Jersey where ventilation can be depended upon in all temperatures. The need for a reliable low-cost automatic temperature regulator was also mentioned.

A paper on the "Purification of Public Water Supplies by Filtration" was presented by Mr. M. N. Baker, of the editorial staff of this journal. It sketched briefly the underlying principles of the subject, pointed out some of the differences between rapid mechanical and slow sand filtration, indicated why the former had been more extensively employed than the later of late, and closed with extracts from data collected for a complete description of water purification plants in operation and abandoned in New Jersey. The latter portion of the paper will be expanded for the printed proceedings of the meeting, and will be given in these columns at a later date.

Dr. B. Meade Bolton read a paper entitled "Bacteriological Diagnosis: Its Sanitary Relations." It was pointed out that attempts to isolate the typhoid bacillus from water suspected of causing the disease had thus far been unsuccessful, and that the same would be largely true of the cholera bacillus were it not for the fact that animal tests with samples of water will often settle this question. It was stated that bacilli do not float about continuously in still air, as is commonly supposed, but quickly settle to the earth or floor; and

that bacteria never get into the air from moist surfaces. Other facts were brought out that tended to show the absurdity of laying epidemics of diphtheria and scarlet fever upon the lack of ventilation or flushing of sewers, essential as these services may be.

In a general discussion on local health boards and their work, Mr. M. N. Baker called attention to the desirability of having an engineer on each board, and of having sanitary engineers rather than physicians for health inspectors. He stated that good candidates for health inspectors are scarce; that men may be found who might be educated to do very efficient work, but that they must be trained by health boards themselves ignorant of many of the subjects involved.

Descriptions of the garbage crematories at Atlantic City, N. J., and Wilmington, Del., were read, respectively, by Mr. W. G. Hoopes and Dr. W. C. R. Colquohon. A Smith furnace is in use at Atlantic City and a Brown at Camden, each of which will be described in a later issue of this journal. Wilmington recently adopted the unusual practice of letting the contract for garbage collection to the highest instead of the lowest bidder, believing that the very poor service formerly given by contractors there was due to their taking contracts at too low figures, expecting to be able to shirk their work, an expectation which was generally fulfilled. Under the new contract the service has been much improved. The average amount of garbage per capita collected in Wilmington during the year ending July 1, 1895, was 265 lbs., against only 90 lbs. as an average for 25 other cities as large or larger than Wilmington. The author did not state how many of these cities had garbage disposal plants to rid themselves of the matter collected.

Mr. Shippen Wallace, of Burlington, N. J., was elected President, and Mr. Jas. Owen, M. Am. Soc. C. E., First Vice-President of the Association for the ensuing year.

NEW PUBLICATIONS.

DECEMBER MAGAZINES.—In "Harper's" this month Caspar W. Whitney describes a journey of hunting and exploration through the great barren wilderness which lies to the west of Hudson's Bay, and to the north of the inhabited regions in Canada's great northwest territory. Richard Harding Davis describes "Caracas," the capital of Venezuela, and incidentally refers to the boundary dispute with Great Britain, which is just now attracting so much attention. In "McClure's" Sir Robert Ball, the English astronomer, writes on "The Sun's Heat," and Cy. Warman, the fireman-poet, describes a tour in the Orient, with characteristic references to Oriental railways. The "Review of Reviews" has a character sketch of Herbert Spencer, by an eminent English scientist, and an able paper on the Venezuela question by the late U. S. Minister to Venzuela, Hon. Wm. L. Scruggs.

In the "Popular Science Monthly" Mr. E. A. Le Seur has a very good critique of Professor Forbes's now classical article on "Harnessing Niagara." It is to be hoped that Professor Forbes sees these various criticisms of his remarkable production, although it is doubtful whether a man so obtuse as to write the "Blackwood" article originally would be able to appreciate the many clever satires with which that remarkable paper was greeted in this country. The most interesting article in this number, however, is a description of "Prehistoric Engineering at Lake Copais," by Mr. John D. Champlin. The drainage of Lake Copais, in Greece, a work recently carried out, has resulted in the discovery of an ancient, partially-completed tunnel. Its total length would have been about 2,400 meters, and 16 shafts were sunk along its line, the deepest 66 meters in depth. More than 500 meters of the tunnel were completed. The shafts have a section of 3 to 4 sq. meters. The rock excavated is hard gray limestone, and the boldness which attempted the execution of so vast a work without the aid of explosives gives one high respect for the courage of the ancient engineers who undertook this great work.

"Scribner's" and the "Century" are both excellent holiday numbers, but contain no papers referring to engineeering or industrial matters, so as to demand noting here. In the "North American Review" Prof. N. S. Shaler has a most able paper on "The Last Gift of the Century." He believes that it is not only possible, but probable, that the close of the century may witness the establishment of an international court of arbitration, authorized to administer a code of international law upon all subjects of controversy between nations. Mr. A. S. White writes on "Our Benefits from the Nicaragua Canal," discussing the scheme, especially with respect to its effect on the foreign trade of the United States. The leading article in "The Forum" is by Leroy-Beaulieu, the famous French economist, and discusses the "Conditions for American Commercial and Financial Supremacy."

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Dec. 13.	Pipe sewer,	Valparaiso, Ind.	Dec. 5
Dec. 14.	Reservoir, etc.,	Tarrytown, N. Y.	Nov. 21
	Advertised, Eng. News, Nov. 21 to Dec. 12.		
Dec. 13.	Grading, etc.,	Boston, Mass.	Dec. 12
Dec. 14.	Artesian well,	Turner, Ill.	Dec. 12
Dec. 14.	Water-works,	Riverside, O. (Cincinnati).	Nov. 21
Dec. 14.	Steel bridges (2),	Denver, Colo.	Nov. 28
Dec. 14.	Tunnel (2,100 ft.), on Pennsylvania R. R.		Dec. 5
	Advertised, Eng. News, Dec. 5.		
Dec. 14.	Penn. R. R. ext'ns (3),	Philadelphia, Pa.	Dec. 5
	Advertised, Eng. News, Dec. 5.		
Dec. 16.	Steam boilers (2),	Newport, Ky.	Dec. 12
Dec. 16.	Electric lighting,	Brooklyn, N. Y.	Dec. 12
Dec. 16.	Plumbing, etc.,	Philadelphia, Pa.	Dec. 12
Dec. 16.	Paving,	Syracuse, N. Y.	Dec. 12
Dec. 16.	Sewers,	Syracuse, N. Y.	Dec. 12
Dec. 16.	Water-works system,	Greenville, Miss.	Nov. 14
	Advertised, Eng. News, Nov. 14 to Dec. 5.		
Dec. 16.	Macadamizing,	Cincinnati, O.	Nov. 21
Dec. 16.	Cast iron pipe,	Atlantic City, N. J.	Dec. 5
	Advertised, Eng. News, Dec. 5 and 12.		
Dec. 16.	Laying water pipe,	Atlantic City, N. J.	Dec. 5
	Advertised, Eng. News, Dec. 5 and 12.		
Dec. 16.	Removal of snow,	New York, N. Y.	Dec. 5
Dec. 16.	Artesian well,	Antonio, Colo	Dec. 5
Dec. 16.	Stone residence,	Victoria, Tex.	Dec. 5
Dec. 16.	Iron bridge,	Kansas City, Mo.	Dec. 5
Dec. 16.	Valves, etc.,	Atlantic City, N. J.	Dec. 5
	Advertised, Eng. News, Dec. 5 and 12.		
Dec. 16.	Cofferdam,	Syracuse, N. Y.	Dec. 5
Dec. 16.	Paving,	Syracuse, N. Y.	Dec. 5
Dec. 16.	Garbage disposal (4 yrs.),	Allegheny, Pa.	Dec. 5
Dec. 17.	Bridge bonds,	Topeka, Kan.	Dec. 12
Dec. 17.	Gas lighting,	New York, N. Y.	Dec. 12
Dec. 17.	Gas supplies, etc.,	Philadelphia, Pa.	Dec. 12
Dec. 17.	Gas holder, etc.,	Philadelphia, Pa.	Dec. 12
Dec. 17.	Steel rails (4,000 tons),	Ottawa, Ont.	Oct. 24
Dec. 17.	Light fixtures,	Rochester, N. Y.	Nov. 28
Dec. 17.	Fireproof shutters,	New York, N. Y.	Nov. 28
	Advertised, Eng. News, Nov. 28 and Dec. 5.		
Dec. 18.	Sewer system,	Benicia, Cal.	Dec. 12
Dec. 18.	Bridges,	Sigourney, Ia.	Dec. 12
Dec. 18.	Bridge abutments,	Indianapolis, Ind.	Dec. 12
Dec. 18.	Street lamps, etc.,	Cleveland, O.	Dec. 12
Dec. 18.	Water-works,	Winton Place, O.	Nov. 21
Dec. 18.	Water-works system,	Falmouth, Ky.	Nov. 28
Dec. 18.	Street cleaning,	Cleveland, O.	Nov. 28
Dec. 18.	Addition to hospital,	Poughkeepsie, N. Y.	Nov. 28
Dec. 18.	Pipe sewers,	Greenfield, Ind.	Dec. 5
Dec. 18.	Bridge,	Indianapolis, Ind.	Dec. 5
Dec. 18.	Bonds ($100,000),	Houston, Tex.	Dec. 5
Dec. 19.	Sewer material,	Baltimore, Md.	Dec. 12
Dec. 19.	Iron bridge,	Hallettsville, Tex.	Dec. 12
Dec. 19.	Boiler house, etc.,	Los Angeles, Cal.	Oct. 31
Dec. 20.	Brick sewers (21,200 ft.),	St. Louis, Mo.	Dec. 12
Dec. 20.	Pipe sewers (44,160 ft.),	St. Louis, Mo.	Dec. 12
Dec. 20.	Recreation buildings,	Binghamton, N. Y.	Dec. 12
Dec. 20.	Fireproof vault,	Brooklyn, N. Y.	Dec. 12
Dec. 20.	Water pipe, etc.,	Hatfield, Mass.	Dec. 5
	Advertised, Eng. News, Dec. 5 to 19.		
Dec. 20.	Canal (30 miles),	Baltimore, Md.	Nov. 28
	Advertised, Eng. News, Nov. 28.		
Dec. 20.	Electric lighting,	Medina, N. Y.	Dec. 5
Dec. 21.	Connecting boilers, etc.,	Buffalo, N. Y.	Dec. 12
Dec. 21.	Railway grading,	Anderson, Ind.	Dec. 12
Dec. 21.	Ditch (112,000 cu. yds.),	Champaign, Ill.	Dec. 12
Dec. 21.	Stone, to be placed at	Plaquemine, Fla.	Dec. 12
Dec. 21.	School building,	Buffalo, N. Y.	Dec. 12
Dec. 21.	Road work,	Stamford, Conn.	Dec. 12
Dec. 21.	Improving streets,	Mansfield, O.	Dec. 12
Dec. 21.	Sewers, etc. (22 streets),	New York, N. Y.	Dec. 12
Dec. 21.	Steel & ironwork for U. S. bldg.,	N. Y.	Nov. 28
Dec. 23.	Storehouse improvements,	Binghamton.	Dec. 12
Dec. 23.	Electric lighting,	Philadelphia, Pa.	Dec. 12
Dec. 23.	Irrigation bonds,	Ogallala, Neb.	Dec. 12
Dec. 23.	U. S. public building work,	Buffalo, N. Y.	Dec. 12
Dec. 23.	Plans for court house,	Milwaukee, Wis.	Dec. 12
Dec. 23.	Court house,	Harrisonville, Mo.	Dec. 12
Dec. 23.	Fire apparatus,	New York, N. Y.	Dec. 12
Dec. 23.	Water wks. extensions,	Riverside, Ill.	Dec. 12
	Advertised, Eng. News, Dec. 12.		
Dec. 23.	U. S. public building work,	Buffalo, N. Y.	Dec. 5
	Advertised, Eng. News, Dec. 5 and 12.		
Dec. 23.	Library building,	Hoboken, N. J.	Dec. 5
Dec. 23.	Tunnel (6,300 ft.),	Colorado Springs, Colo.	Dec. 5
	Advertised, Eng. News, Nov. 21 to Dec. 19.		
Dec. 23.	Heating & ventilating,	Canton, O.	Nov. 28
Dec. 24.	Lumber for canal repairs,	Albany, N. Y.	Dec. 12
Dec. 26.	Brick sewer (1,900 ft.),	Elizabeth, N. J.	Dec. 12
Dec. 26.	Water supply, Ft. Hall Ind. Res.	Idaho.	Nov. 28
Dec. 26.	Removal of wreck,	Boston, Mass.	Dec. 5
Dec. 26.	Breakwater (200 ft.),	Agate Bay, Minn.	Dec. 5
Dec. 26.	Paving bonds ($15,000),	Westwood, O.	Dec. 5
Dec. 27.	Electric light poles (20),	Denver, Colo.	Dec. 12
Dec. 27.	Public lighting,	Elizabeth, N. J.	Dec. 12
Dec. 27.	48-in. cast iron pipe,	Boston, Mass.	Dec. 12
	Advertised, Eng. News, Dec. 12 and 19.		
Dec. 27.	Lamps (750),	New York, N. Y.	Dec. 5
Dec. 28.	Water-works system,	Turner, Ill.	Dec. 12
Dec. 28.	Sewer pipe (61,048 ft.),	Arlington, Mass.	Dec. 12
	Advertised, Eng. News, Dec. 12 and 19.		
Dec. 30.	Sewers,	Piqua, O.	Dec. 12
Dec. 30.	Steel bridges (2),	Denver, Colo.	Dec. 12
Dec. 30.	Stone, Sand Island Light Station,	Ala.	Dec. 12
Dec. 30.	School building,	Norwich, Conn.	Dec. 12
Dec. 30.	Plans for court house,	Wheeling, W. Va.	Dec. 12
Dec. 30.	Heating and ventilating,	Mankato, Minn.	Dec. 12
Dec. 31.	Public lighting,	Davenport, Ia.	Dec. 12
Jan. 2.	Lighthouse work,	Mobile, Ala.	Dec. 12
	Advertised, Eng. News, Dec. 12 and 19.		
Jan. 2.	Plumbing, etc.,	Baton Rouge, La.	Dec. 12
Jan. 2.	Building bonds,	Newark, O.	Dec. 12
Jan. 2.	Garbage crematory,	Dayton, O.	Dec. 5
Jan. 6.	Bridge,	Astoria, Ore.	Nov. 21
Jan. 7.	Lift bridge,	Middletown, O.	Dec. 12
Jan. 7.	Street ry. franchise,	New Orleans, La.	Oct. 17
Jan. 7.	Pumping engine,	Red Wing, Minn.	Nov. 28
Jan. 7.	Dredging,	Collingwood (Ont.) Harbor.	Dec. 5
Jan. 7.	Iron bridge,	Annapolis, Md.	Dec. 5
Jan. 10.	Plans for water-works,	Unionville, Mo.	Dec. 12
Jan. 10.	Pumping engine,	Washington, D. C.	Dec. 12
	Advertised, Eng. News, Dec. 12.		
Jan. 11.	Plans for school bldg.,	Williamsport, Pa.	Dec. 12
Jan. 13.	Plans for court house,	Galveston, Tex.	Nov. 21
Jan. 15.	Electric light bonds,	Niles City, Mont.	Dec. 12
Mar. 3.	Street railway franchise,	New Orleans.	Dec. 5
No date.	Brewery,	Detroit, Mich.	Dec. 12

RAILWAYS.

East of Chicago.

BALTIMORE & OHIO.—A corps of engineers of this company has completed the location of the line from a point on the Washington County branch, a short distance north of Gapland, to Marland Heights, Harper's Ferry. The line runs along the eastern side of Elk Ridge Mountain, rising by a regular grade of 100 ft. to the mile until it gains the top of the Maryland Heights. The line was reported to be feasible.

GRAND TRUNK.—It is reported that this company contemplates the building of a branch from West Paris, Me., to Rumford, Andover and the chain of lakes to the northward. Ch. Engr., E. P. Hannaford, Montreal, Que.

INDIANA CENTRAL.—The county commissioners of Jay county, Indiana, have been petitioned to call a special election to vote on a subsidy of $43,000 for the above road. The petition provides that no part of the subsidy shall be payable until the completion of the line from Union City to Huntington, passing through Portland.

JAMESTOWN & LAKE ERIE.—E. T. Haines, Pres., Jamestown, N. Y., writes us that the proposed extension of this road will connect Jamestown with Ellicott, 4 miles distant. All surveys have been completed and right of way has been obtained. Under date of Dec. 7 no contracts had been let, but it is the intention of the company to award contracts immediately. Ch. Engr., C. R. Mambert, Jamestown, N. Y.

LIMA NORTHERN.—It is stated that entrance to Toledo will be had by this company during the winter, over the tracks of the Toledo, St. Louis & Kansas City R. R.

PORTLAND & CAPE ELIZABETH.—It is reported that this company has filed a trust mortgage on its property, by which it proposes to issue $400,000 worth of 5% bonds. The provisions are that $250,000 worth of bonds shall be at once placed at the disposal of the company; $50,000 shall be delivered from time to time, and $100,000 shall be delivered when 15 miles of track is in operation. The company is now ready to operate a road between Cape Elizabeth and Portland, Me.

SMETHPORT & OLEAN.—Incorporated in Pennsylvania, on Dec. 5, to build a railway from Smethport to the New York state line in McKean county, a distance of 18 miles; capital stock, $400,000; directors, Geo. J. Wolf, President; A. G. McComb, James George, H. A. Jackson, S. H. Smith and M. G. Raub, all of Bradford, Pa.

Southern.

CENTREVILLE.—It is reported that the Duck River Phosphate Co. is building a nine-mile railway from Totty's Bend to Centreville, Tenn. The phosphate rock has heretofore been transported by wagons and by barges on the river, often to the amount of 100 tons a day.

CHESAPEAKE & OHIO.—H. Frazier, Ch. Engr., Richmond, Va., writes us that he has no knowledge of any extension to be undertaken by this company of the branch terminating at Richardson, Ky., a rumored project noted in our issue of Nov. 28.

FLORIDA EAST COAST.—The contract for the construction of 50 miles of the extension from Palm Beach to Miami, has been let, according to a press report, to Bryan & Patterson, railway contractors of Jacksonville, Fla., and work has already been commenced. Supt., R. T. Goff, St. Augustine, Fla.

KING'S MOUNTAIN & YOSEMITE.—This Kentucky railway, which connects with the Cincinnati Southern at King's Mountain, and runs westerly 13 miles, has been sold by decree of court. The Alabama & Great Southern was the purchaser, the amount paid being $5,000.

LOUISVILLE & NASHVILLE.—The extension from Shelbyville, Ky., to Christiansburg now under construction, will probably be completed Dec. 15.

MONTGOMERY & EUFAULA.—This road, which is the last of the old Georgia Central property, was sold under decree of the court on Dec. 7 at Montgomery, Ala. It was bought by Thomas & Ryan, of New York, for $500,000.

SOUTHERN.—This company will inaugurate its service into Norfolk, Va., during the first week in January, running its trains over the Wilmington & Weldon from Selma, N. C., to Tarboro, and over the Norfolk & Carolina from the latter point to the new terminal at Pinner's Point on Norfolk Harbor. The Southern will at once become an active competitor of the other roads terminating at Norfolk, and expects to secure its share of business from the steamer lines.

Northwest.

BALTIMORE & OHIO.—Press rumors say that this company is to obtain entrance to Kansas City, from its present western terminus at Beardstown, Ill. From Beardstown to Quincy a new line will be built, connecting at the latter place with the Quincy, Omaha & Kansas City, which extends to Trenton, Mo., 70 miles from St. Joseph. Here another connecting link is to be constructed. It is reported also that the Illinois Central will make arrangements for a joint use of this route with the Baltimore & Ohio.

CHICAGO, BURLINGTON & QUINCY.—The freight yards of this company, situated between Clyde and Morton Park, about eight miles from the terminal station in Chicago, are to be doubled in their capacity.

CROOKED CREEK.—Incorporated in Iowa on Dec. 2 to build a coal railway from Lehigh to Judd, both in Webster county, also to Webster City, Hamilton county; capital stock, $500,000; incorporators, Charles T. Burnham, W. C. Willson, Jacob M. Funk, E. L. Hanson, A. K. Hamilton, F. E. Willson, Phoebe Q. Burnham, John Q. Burnham and Marie D. Burnham.

DUBUQUE.—The project noted in our issue of Nov. 21 to build a railway west from Dubuque, Ia., to a connection with the Chicago & Northwestern Ry. at Toledo, Ia., is being pushed with vigor by the citizens of Dubuque. At a meeting Dec. 4 a board of directors was selected, consisting of representative business men. It is proposed to put engineers in the field at once and to survey two routes, terminating at Toledo and Gladbrooke. Chas. T. Hancock, Geo. B. Burch and James McCann, all of Dubuque, are interested.

HURON BAY & IRON RANGE.—Press reports state

that the Northern Michigan road, which was built several years ago and has never been used, will be extended to the copper mines. Surveyors are at work running lines around Keeweenaw Bay. The present line connects Champion with Huron Bay.

MARINETTE, TOMAHAWK & WESTERN.—This road has contemplated tracklaying from Tomahawk, Wis., to Harrison, making connection at the latter place with the Chicago & Northwestern, and at the former with the Chicago, Milwaukee & St. Paul and the Wisconsin & Chippewa.

Southwest.

ALVIN, BRAZORIA & WESTERN.—J. O. McBride, Pres., Alvin, Tex., writes us that active work on this project will be commenced at once. Preliminary surveys have been partly made, and right of way agents are at work; $200,000 in property has been already donated, although no active canvass has yet been made. The route, so far as decided upon, will touch Alvin, Angleton, Brazoria and Bay City.

MISSOURI, KANSAS & TEXAS.—J. W. Petheran, Ch. Engr., Dallas, Tex., writes us that no work of any sort has yet been done toward the extension into San Antonio or Austin.

SANTA FE, OKLAHOMA & WESTERN.—According to a press report, a charter has been issued by Oklahoma Territory to a company bearing the above name. The intention is to build a railway from Sapulpa, Ind. T., to Vernon, Tex.

TEXAS CENTRAL.—It is reported that this company is perfecting plans for an extension in the direction of New Orleans, with the intention of ultimately reaching that point and making the Texas Central a trunk line. Its present extent is 187 miles, from Ross to Albany, and from Ross to Waco 11 miles is leased from the Houston & Texas Central. This short stretch will be bought or paralleled if the above plans are carried out. Ch. Engr., Jos. McWilliams, Waco, Tex.

WICHITA VALLEY.—J. V. Goode, Gen. Supt., Ft. Worth, Tex., informs us that no move will be made at present in the matter of the extension from Seymour to Abilene, Tex., a project noted in our issue of Nov. 28.

Rocky Mt. and Pacific.

SOUTHERN CALIFORNIA.—Press reports state that arrangements have been made to build a nine-mile extension through Elsinore, Cal., to the coal and clay mines in that vicinity, connecting with the main line at South Riverside.

Foreign.

PEKIN, CHINA.—It is reported that an imperial edict has been issued, ordering the construction of a double-track railway between Pekin and Tien-Tsin, a distance of 72 miles. The rails used will weigh 85 lbs. to the yard, and the cost of construction will be 3,000,000 taels, or about $2,200,000. It is said that American capitalists are interested.

STREET AND ELECTRIC RAILWAYS.

CHERRYFIELD, ME.—Articles of association of the Cherryfield & Millbridge Electric Railway have been filed with the railroad commissioners; capital stock, $30,000; directors, S. D. Leavitt, Eastport; Geo. A. Curran and G. A. Murch, Calais; W. M. Nash and G. R. Campbell, Cherryfield; James Mitchell, Portland. The road will be five miles in length, and will connect with the Washington County Ry.

NORWAY, ME.—The road from South Paris to Norway, now operated by the Grand Trunk Ry. as a branch line, may be equipped in the near future with electricity, connecting with the electric street railway lines at Norway. H. L. Shepherd, of Rockland, Me., and Geo. L. Beal, of Norway, have been appointed a committee to confer with the Grand Trunk officials.

CHESTER, N. H.—C. S. Campbell, Derry, N. H., writes us that the 7½-mile Chester & Derry road has been located, and that sufficient stock has been taken to insure building. Contracts for construction will be let as soon as the report of the chief engineer has been presented. Ch. Engr., A. W. Dudley, Exeter, N. H.

AMHERST, MASS.—J. C. Hammond, Northampton, Mass., writes that there is little prospect of building the Northampton-Amherst electric railway before the end of two years.

EDGARTOWN, MASS.—A project is on foot to build a road on Martha's Vineyard Island, to be known as the Martha's Vineyard St. Ry., and to connect Edgartown with Cottage City and Tisbury. Promoters of the enterprise are said to be: John R. Graham, John A. Dugann, Fred. H. Smith, Josiah Quincy, and others.

BATAVIA, N. Y.—An extension of time has been granted to A. B. Wilgus, Bennett Bldg., New York, for the construction of the Batavia electric road. Aug. 1, 1896, is named as the day on which three miles of the line must be in operation. It has been proposed to use the electric current of the Niagara Falls Power Co.

COHOES, N. Y.—It is reported that the new line of the Cohoes City Ry. to the southern limit of the city will be completed and in operation by Dec. 15.

LEWISTON, N. Y.—An electric road is projected from Lewiston to Youngstown. No active work has as yet been done, aside from efforts to arouse public interest in the enterprise, and the formation of a company, with L. D. Rumsey as president and Paul Voorhees as chief engineer.

LONG ISLAND CITY, N. Y.—According to a press report, a syndicate of Philadelphia capitalists has acquired the entire street railway system and electric lighting plant of Long Island City. There are about 60 miles of trolley road in operation, and additional mileage will soon be completed. It is understood that the deal represented a transaction of nearly $2,000,000.

NEW BRIGHTON, N. Y.—The village trustees have granted to the Staten Island Electric Co. a franchise permitting the use of several streets in that place.

WATERTOWN, N. Y.—Joseph A. Lawyer, Watertown, has been appointed by Justice P. B. McLennan, of Syracuse, receiver of the consolidated electric railway company, of Watertown and Brownville, on the application of the Central Trust Co., of New York. Plans for reorganization have not been published, but a re-equipment of the road will have to be made before it can be placed on a paying basis.

WHITE PLAINS, N. Y.—The New York, Elmsford & White Plains Ry. Co. is planning several extensions, of which the most important is that from White Plains to Mamaroneck. An important extension which will receive attention in the near future is from Elmsford to Tarrytown, on the Hudson River. At present, the other new work contemplated is confined to the streets of White Plains.

WEST ORANGE, N. J.—The Orange Mountain Traction Co. has been incorporated; capital stock, $150,000; incorporators, Walter G. MacFarland, 142 S. Fourth St., Philadelphia; Wm. S. Hood, Camden, N. J.; L. G. Dodge, Philadelphia. It is the intention of this company to purchase the property and franchises of the Orange Mountain Cable Co.

BRISTOL, PA.—The contract for building the Newtown, Langhorne & Bristol Electric Ry. has been awarded to G. H. S. Brabaker, of Lancaster, Pa.

CORRY, PA.—Incorporated on Dec. 10, the Corry St. Ry. Co., which proposes to build a railway in the streets of Corry; capital stock, $25,000, paid in. Address for information, Manley Crosby, Corry, Pa.

PITTSBURG, PA.—A charter was granted on Dec. 9 to the City Inclined Plane Co., which proposes to build an inclined plane road over the Monongahela River, starting from a point on Fourth Ave., and ending at the top of Mt. Washington. The structure will be about 6,000 ft. long and 40 ft. wide, with double tracks, and a grade of between 9 and 10%. Its chief feature will be a suspension span 1,565 ft. long. The towers at each end will be 250 ft. high.

BALTIMORE, MD.—Permission has been granted to the Baltimore & Gunpowder Ry. Co. to build an electric road from the eastern suburbs of the city to Gunpowder Falls. Ch. Engr., Chas. B. McLean.

BASIC CITY, VA.—It is stated that the Basic City, Bridgewater & Western Electric Ry. Co. has completed a survey between Basic City and Bridgewater, a distance of about 25 miles.

ST. AUGUSTINE, FLA.—Surveys and plans have been made under the direction of J. F. Le Baron, of Jacksonville, Fla., for the extension of the Jacksonville, Mayport & Pablo Beach Ry. & Navigation Co.'s road from Burnside Junction to St. Augustine, via Pablo Beach and Deigo, about 33 miles. It is proposed to purchase the Jacksonville & Atlantic, a narrow-gage road, 17 miles long, running to Pablo Beach, and take up the rails to use on the above extension, but it is doubtful if this can be done, since the Jacksonville & Atlantic holds a land grant from the state, given in consideration of the operation of the road. It is the intention to operate the system by electricity.

CHATTANOOGA, TENN.—The Chattanooga St. Ry., an electric system, is to be sold on Dec. 23. It is said that the prospective purchasers intend to undertake extensive improvements in the service of the road.

HARTFORD, KY.—A. J. Casey, of Owensboro, Ky., writes us concerning the Hartford, Beaver Dam & McHenry Ry., projected to extend a distance of five miles from Hartford to the Williams Coal Co., near McHenry, that a survey has been made and right of way nearly all secured. Contracts will probably not be let until spring. It has not yet been decided whether the motive power will be electricity or steam. Ch. Engr., Henry Talbot, Owensboro, Ky.

AKRON, O.—Press reports state that a deal has been consummated whereby the Akron St. Ry. and the Akron General Electric Light plant was sold for $1,200,000 to a New York syndicate, of which Samuel Thomas is the moving factor. It is probable that additional property was included in the deal, if the reported price is correct.

COLUMBUS, O.—The county commissioners have thus far refused to grant an extension of time for the construction of the Columbus & Harrisburg Electric St. Ry., which was to have been built by Jan. 1, 1896. Practically no work has been done on the road, and the franchise will consequently be forfeited, unless the promoters can convince the commissioners of their intention to build.

FERNBANK, O.—It is stated that the Cincinnati St. Ry. Co. has made a proposition to extend its line from Anderson's Ferry to Fernbank, provided a bonus of $50,000 is raised by the citizens of that place.

LIMA, O.—It is reported that the promoters of the electric line from Lima, via Wapakoneta and St. Marys, to Piqua, have now completed their survey, and contracts for grading the route and constructing the line are being considered. Work is to be commenced before Jan. 1.

MANSFIELD, O.—An electric road is projected from Mansfield to Wellington, O., to be known as the Mansfield, Savannah & Wellington Electric R. R. T. Y. McCray, of Mansfield, is interested in the project.

ANDERSON, IND.—Bids are asked by Chas. L. Henry, Manager, until Dec. 21 for grading the electric railway from Anderson to Alexandria for a distance of seven miles, and a total amount of earthwork 35,000 cu. yds. Work is to be completed April 15. For information address H. H. Rogers, Cy. Engr., Anderson, Ind.

NEW CASTLE, IND.—It is stated that a company has been organized, with A. A. Chadwick as President, to build an electric line from New Castle to Cadiz, Greensboro and Knightstown.

BIRMINGHAM, MICH.—Work on the electric line connecting Birmingham with Detroit has commenced. Rails and ties are already purchased, and it is expected that cars will be running by Jan. 15. In the spring the road will be extended to Pontiac. Strathearn Hendrie, of Detroit, is interested.

CHEBOYGAN, MICH.—The Cheboygan St. Ry. is to be equipped with electricity. Address D. J. Kennedy, Bay City, Mich.

WAUKESHA, WIS.—Application has been made to the village board by the Milwaukee & Waukesha Electric Ry. Co. for a franchise to operate a street car system here. Should the franchise be granted, work will begin on the road in the spring. It is intended to connect with the proposed line to Milwaukee.

KANSAS CITY, MO.—The Metropolitan St. Ry. Co. is perfecting plans for a large power house to be built near Riverview, and which is to furnish power to all the electric lines of its system west of Main St.

TACOMA, WASH.—E. L. Jones, Secretary of the Air Line Ry. Co., which is projected to connect Tacoma with Seattle, writes us that preliminary surveys have been made, insuring a route with a maximum grade of 2½%. Right of way has been secured. The capital stock of $250,000 has not as yet been entirely taken up. No contracts have been let. The distance by this projected route is 29 miles, 12 miles shorter than any existing transportation line. Engrs., Bosworth & Chapman, Tacoma, Wash.

SAN BERNARDINO, CAL.—The San Barnardino, Arrowhead & Waterman R. R. was sold in court on Nov. 27 to F. Kohl, of Centralia, Ill., for $12,000. Some improvements will be made before the resumption of traffic takes place. An oil-burning locomotive is to be used on the road.

STOTTSVILLE, QUE.—The Napierville Junction Ry. is an electric road to be built between Stottsville and St. Remi, Que. A subsidy of $3,500 per mile has been obtained from the Dominion government, and several towns have granted bonuses. Six miles of right of way has been secured, and it is stated that active work will begin at once. At Stottsville connection will be had with the Grand Trunk Ry.

BELLEVILLE, ONT.—Permission has been granted to the Belleville Traction Co. by the Ontario government to build an electric railway in the streets of Belleville. The capital stock of the company is $100,000. The incorporators are S. A., T. C. and R. E. Lozier, of Belleville.

TORONTO, ONT.—An organization under the name Toronto, Hamilton & Niagara Falls Electric Ry. Co. has been effected for the purpose of building a railway between these cities.

VANCOUVER, B. C.—It is reported that an English syndicate has absorbed the Vancouver Electric Tramway Co., the Vancouver Electric Light Co., the New Westminster & Vancouver Interurban Electric Tramway & Light Co., and the New Westminster City Electric Tram Co. It is said that the water power of the Seymour River will be used to furnish power for the entire system.

ELECTRIC LIGHT AND POWER.

RICHFORD, VT.—A new electric light plant is being considered, according to reports.

BROOKLYN, N. Y.—Bids are asked until Dec. 16 for furnishing electric lights for the streets and public buildings during the year 1896; surety, $15,000. Alfred T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—The aldermen have passed an ordinance granting the Niagara Falls Power Co. a franchise at 2½% on the gross earnings, instead of 5%.

ROCKVILLE CENTRE, N. Y.—A company has been organized to construct an electric light plant.

SCHENEVUS, N. Y.—The "Monitor" is agitating the question of electric lights.

WHITESTONE, N. Y.—The construction of an electric light plant in connection with the water-works is being considered. Wm. Joyce, Water Comr.

BOONTON, N. J.—We are informed that the board of trade is seeking information relative to the cost of an electric plant for public and private lighting. Any information received by the committee will be considered at its next meeting. G. W. Vincent, Chn. Electric Light Com., Boonton Board of Trade.

ELIZABETH, N. J.—Bids are asked until Dec. 27 for furnishing 50 arc and 750 incandescent lights, or the same number of gas, naphtha or gasoline lights for three years. James J. Manning, Cy. Clk.

NEWARK, N. J.—It is reported that the People's Electric Light & Power Co., of Newark, has secured the controlling interest in the Essex County Electric Light & Power Co. Orange and West Orange are supplied with electric lights by the latter company. The acquisition of the Orange company is but the first move toward forming an electric light company that will supply all the smaller towns outlying Newark. Harrison is already included in the scheme, and it is said Jersey City as well.

TRENTON, N. J.—The question of a municipal electric light plant is being discussed by the council, according to reports.

MOUNT CARMEL, PA.—It is stated that the directors of the Edison Electric Light Co. have voted to re-equip and extend their plant.

PHILADELPHIA, PA.—Bids are asked until Dec. 23 for lighting the city by electricity, according to local papers. A. M. Beitler, Dir. Pub. Safety.

READING, PA.—The question of a municipal electric light plant is being considered. Edward Chamberlain, Cy. Engr.; H. H. Hammer, Cy. Clk.

SISTERSVILLE, W. VA.—It is reported that H. L. Kerr has secured an electric light franchise for McGhie & Moore, of East Liverpool, O.

HENRIETTA, N. C.—It is stated that an electric plant of 1,000 lights will be installed by the Henrietta Cotton Mill.

OXFORD, N. C.—Estimates are wanted, it is stated, for an electric light plant. B. S. Royster, Mayor.

DUBLIN, GA.—Surveys have been completed for an electric plant of 30 arc and 600 incandescent lights, and for a water-works plant.

BRIDGEPORT, FLA.—The Cypress Tank Co., it is said, is about to purchase an incandescent light plant.

LAKE CITY, FLA.—We are informed that the Lake City Water & Light Co. has secured a 10-year franchise for lighting the city with electricity. The company wants prices on two dynamos, one 50-arc light and one incandescent 60 K.-W., or 1,000-c. p., lights. Two engines of the best automatic make, about 50 and 75 HP., are needed; also lamps and all wire necessary for circuit of about three miles for arc and four miles for incandescents. There will be needed 30 1,200-c. p. arc lights to begin with, and about 300 incandescents, 16 c. p., and 50 street series 32-c. p. incandescents protected. Address W. R. Bush, care of Lake City Water & Light Co.

SHEFFIELD, ALA.—This city has voted to issue bonds for an electric light plant and water-works, according to reports.

MERIDIAN, MISS.—W. R. Hall, of Chattanooga, Tenn., is reported as making arrangements for constructing at once an electric light plant and a five-mile electric railway.

PORT GIBSON, MISS.—Thos. M. Rea, Cy. Clk., writes us that at the election held Dec. 2 it was voted not to construct an electric light plant and water-works.

LAFAYETTE, LA.—Robt. T. P. Zell, Goodcheaux Bldg., New Orleans, La., will make surveys and estimates for an electric light plant and water-works.

NEW ORLEANS, LA.—J. J. Cohen and M. Ber are re-

ported about to be granted a franchise for an electric light plant, to cost $150,000, work on which will be begun as soon as the franchise is granted.

LONDON, O.—F. R. Rae, of Detroit, Mich., is preparing plans for an electric light plant. The plans are to be completed in a few days. John D. Redden, Cy. Clk.

MADISONVILLE, O.—The electric light trustees are reported as considering purchasing a new dynamo.

ATLANTA, IND.—It is stated that the capital has been secured by a recently-organized company for the construction of an electric light plant of 50 lights.

FRANKFORT, IND.—Alonzo J. Hammond, Cy. Engr., writes us that the electric light company is intending to add an incandescent light and power system to its plant. The plant has been in operation for about seven years, and no complete new plant is now being considered, as has been reported. James A. Price, Cy. Clk.

BUCHANAN, MICH.—Press reports state as follows: The water power, dam, equipment, franchises, etc., of the Buchanan Water Power & Electric Lighting Co. will be sold Jan. 17, that company having made a failure of its project. The water power is derived from a dam 400 ft. wide across the St. Joseph River at this place, a fall of 12 ft. giving a power estimated at from 2,500 to 4,000 HP. The company has expended $125,000 on its power.

LOWELL, MICH.—C. C. Winegas, E. R. Collar and D. G. Look have been appointed a committee to secure estimates for equipping an electric light plant, according to reports.

CARROLLTON, ILL.—It is stated that the council has decided to advertise for bids for constructing an electric light plant.

MOWEAQUA, ILL.—J. H. Culver, of Decatur, Ill., is said to be about to begin the construction of an electric light plant of 10 arc and 500 incandescent lights. M. R. Stine and R. D. Wilson, of Moweaqua, are interested.

ELMHURST, ILL.—The Elmhurst Electric Light & Power Co. has increased its capital stock from $15,000 to $30,000.

DAVENPORT, IA.—Bids are asked by the gas and light committee until Dec. 31 for lighting the city for five years from June 1, 1896. Ernst Zoller, Chn. Com.; E. W. Boynton, Comr. Pub. Wks.

GRINNELL, IA.—The council has been petitioned for a franchise for a new electric light plant.

SEARCY, ARK.—It is stated that M. G. Petty, of Searcy, proposes to purchase machinery for extending the electric light plant.

NORTHWOOD, N. DAK.—The question of putting in an electric light plant is again being considered.

UNION, MO.—Chas. L. Moore, County Surv., is making surveys for a projected power plant on the Meramec River. It is proposed to furnish electricity for lighting purposes in St. Louis, and also to supply motive power for the street railways. It is reported that an outlay of $10,000,000 is contemplated.

UNIONVILLE, MO.—Plans and specifications are asked until Jan. 10 for an electric light plant and water-works to cost not more than $18,000. G. H. Gardner, Cy. Clk.

TERRELL, TEX.—M. A. Joy, of Terrell, is reported about to buy machinery for addition to the electric light plant.

DENVER, COLO.—Bids are asked until Dec. 27 for furnishing 20 iron electric light poles for the state capitol grounds. Bids are asked until Dec. 12 for the electric light plant for the capitol. James Murdoch, Supt.; Herman Lueders, Secy., Capitol Bldg.

NEW CASTLE, COLO.—It is said that the city has voted to construct an electric light plant. Samuel Wraith, Chn. Com.

MILES CITY, MONT.—Bids are asked until Jan. 15 for the purchase of $17,000 of 6% electric light and water bonds. These bonds are issued to purchase the existing plants. S. Gordon, Cy. Clk.

CATHLAMET, WASH.—An electric light plant is to be put in here, and reports say that the power will be secured from Burning Creek.

MONTESANO, WASH.—An electric light plant is to be constructed at this place, according to reports.

RIVERSIDE, CAL.—It is probable that the contract for constructing an electric light plant in this city will be let about Jan. 1. Address E. C. Sharpe, Elec. Engr.

SANTA CRUZ, CAL.—It is stated that no bids were received Nov. 20 for the electrical machinery for the water power plant estimated to cost $68,000, as noted in our issue of Nov. 14. F. W. Swanton, Santa Cruz, is the promoter.

SAN FRANCISCO, CAL.—The San Francisco Gas Light Co. proposes to adopt the Siemens-Halske electric light system. Engr., O. S. Lyford, of the Siemens-Halske Co., Chicago, Ill.; Pres., J. B. Crockett, San Francisco.

SAN LEANDRO, CAL.—An election is to be held Dec. 16 to vote on the question of issuing $10,000 in bonds for an electric light plant, according to reports.

AYLMER, QUE.—R. H. Conroy and W. Conroy have submitted a proposition for lighting the city by electricity.

HAMILTON, ONT.—E. A. C. Pew proposes to construct a waterway from the Grand River for transmitting power to Hamilton.

TORONTO, ONT.—It is reported that the Toronto Electric Light Co. is soon to build a new arc light plant at a cost of about $20,000.

NEW COMPANIES.—Bronson Electric Co., Bronson, Mich.; $10,000; H. P. Mowry, J. S. Shonemen, J. F. Werner, Bronson; F. C. Rheubottom, Wm. H. Bond, of Union City.

Clay City Electric Light Co., Clay City, Ind.; $5,000; William Parsons, Charles S. Nickey, Benjamin M. Guirl.

Bedford Electric Light Co., Bedford City, Va.; $25,000; T. D. Berry, J. A. Clarke and C. E. Harris, Bedford City, Va.

Hayes, Tracy, Fyfe Co., Chicago, Ill.; $30,000; to manufacture electrical and mechanical devices; James Hayes, Edward C. Tracy; Herbert H. Schryver.

Salida Electric Co., Denver, Colo.; to operate in Chaffee county; $50,000; Thomas B. Stearns, John W. O'Connor, William F. Bagat, John D. Farrish, Joel W. Stearns.

McKee's Rocks Electric Light Co., McKee's Rocks, Pa.; $20,000, with $2,000 paid in; Treas., David Shaw, Robert Murdock, McKee's Rocks; Steven Newburn, Bellevue, Pa.

Parry Sound Electric Light Co.; Parry Sound, Ont.; $200,000; W. H. Pratt, Toronto; W. B. Armstrong, S. Armstrong, John Galna, Wm. Beatty, T. S. Walton, Parry Sound.

National Electric Carbon & Mfg. Co., Boston, Mass.; $500,000; to manufacture carbon machines and carbons; Pres., William A. Holmes, Boston; Treas., Charles F. Clark, Boston.

New Orleans Edison Co., New Orleans, La.; to operate electrical plants and works, including electric railways; $3,000,000; J. P. Ord, R. T. Paine, R. T. McDonald, Wm. T. Hardie, Wm. P. Nicholls.

Western Lumber Co., Portland, Ore.; $100,000; to manufacture all articles made of wood, to do a logging and warehouse business, operate lumber mills, flumes, ditches, roads, railways, tramways and steamboats, and to acquire electrical plants for power and lighting purposes; W. B. Ayer, M. F. Henderson, J. H. Peterson.

BRIDGES.

BOSTON, MASS.—Wm. Jackson, Cy. Engr., has prepared plans for a $300,000 bridge over the Charles River from Pleasant St., Boston, to Magazine St., Cambridge. The bridge will be of iron, 60 ft. wide, with stone piers and a draw.

FALL RIVER, MASS.—It is stated that the city engineer has prepared plans for eight iron bridges, to be erected next year, in order to abolish grade crossings.

WESTERLY, R. I.—The New York, New Haven & Hartford R. R. Co. is to build a bridge 32 ft. wide over its tracks at High St. J. B. Gardiner, Div. Supt.

BINGHAMTON, N. Y.—The county supervisors are considering the question of constructing a $16,000 bridge over the Chenango River in Port Crane. Frank Robbins and Joshua Underwood are supervisors.

BUFFALO, N. Y.—Ex-Repesentative Farquhar is interested in a projected bridge to Grand Island. It is stated that the structure will have a 200-ft. channel draw.

BUFFALO, N. Y.—Local papers state that bids will be asked at once by the board of public works for constructing the substructure for a lift bridge 150 ft. long over the Buffalo River at Michigan St. There will be two shore spans of about 45 ft. each. The Wisconsin Bridge & Iron Co., Milwaukee, was awarded the contract for the superstructure recently at $38,700. The council appropriated $75,000 for the bridge, which, it is said, will not be sufficient, as the substructure will be massive. Designing Engr., Samuel J. Fields, Bureau of Engineering, Dept. Pub. Wks.

SYRACUSE, N. Y.—Plans are being prepared for a hoist bridge over the railway tracks at West Genesee St.

ATLANTIC HIGHLANDS, N. J.—A $3,000 bridge of steel and concrete, with a span of 50 ft., is to be built over Grand Ave., Atlantic Highlands, for which the borough is to contribute $800, according to reports.

JERSEY CITY, N. J.—A viaduct, to cost $100,000, is to be constructed at 13th St., according to reports. A. J. Corcaran and John Casey are interested.

NEWARK, N. J.—It is probable that the bridge voted upon Nov. 5, but defeated, will yet be built over the Passaic River, from Madison St., Newark, to Fourth St., Harrison. The structure will cost $100,000, which will be divided equally between Essex and Hudson counties. John Boyd, Clk. Bd. Freeholders, Jersey City.

HARRISBURG, PA.—Plans have been prepared for reconstructing a portion of the State St. bridge, the steel work for which will be paid for by the Harrisburg Traction Co.

OIL CITY, PA.—The citizens are about to petition for a new bridge over Oil Creek. A. T. Hyde, Cy. Engr.

PHILADELPHIA, PA.—The council is discussing the construction of a new bridge at Gray Ferry, estimated to cost $750,000, one-third to be paid each by the city, the Pennsylvania R. R., and the Philadelphia Traction Co. J. Gray Bolton, Chn. Com.

HIGHLANDTOWN, MD.—The contract for the double-track viaduct 600 ft. long for the Baltimore, Middle River & Sparrow's Point R. R. Co., over the P., W. & B. R. R., at Highlandtown, has been awarded to the Structural Iron Erecting Co., of Baltimore.

FERNANDINA, FLA.—W. B. Ballantine, Chn. Bd. County Comrs., writes us that he has been authorized to secure estimates for a 137-ft. bridge, with a 60-ft. draw, at the Marsh Road.

CINCINNATI, O.—The residents of North Fairmount have petitioned the board of administration for a viaduct on Harrison and Western Aves., to cost about $175,000. Casper Lascher is interested.

DAYTON, O.—F. M. Turner, Cy. Engr., has been directed to prepare plans for two bridges over the Miami River, 604 and 600 ft. long, respectively.

MIDDLETOWN, O.—Bids are asked until Jan. 7 for constructing an iron or steel hoist or swing bridge, 60 ft. long, over the Miami & Erie Canal, on the Franklin Road, in Middletown. It is reported that bids for this work were received Nov. 19, but were rejected. Frank X. Duerr, County Audr., Hamilton, O.

YOUNGSTOWN, O.—It is reported that the county commissioners have decided to construct at once a $40,000 bridge at Spring Common, a $150,000 bridge at Market St., and also a $50,000 structure at South Ave., all to be over the Mahoning River. John M. Davis and John McMillan can be addressed.

BRAZIL, IND.—Plans and specifications have been received by the mayor for a bridge over the railway tracks at Chestnut St., according to reports.

INDIANAPOLIS, IND.—Bids are asked until Dec. 18 for constructing a bridge across White River, near the southern limits of Indianapolis. Two spans of 225 ft. each and a 20-ft. roadway, no sidewalks. Steel, designed for 100 lbs. per sq. ft. or a load of 10 tons on 6 × 10-ft. wheelbase, four wheels. Also piers on pile and concrete foundations, two for abutments, 28 × 17 ft. at top of foundation with wings 25 ft. long, about 33 ft. high, and pier in center 12 × 31 ft. at bottom, same height. Stratfield or oolitic limestone, bids will be received on both kinds of stone, and will be received for the substructure and the superstructure, or both. Jos. T. Hunter, Clk. Co. Bd.——Bids are asked until Dec. 18 for extending the abutments of the Spruce St. bridge. The bids for this work recently received were too high. B. J. T. Jeup, Cy. Engr.

LAFAYETTE, IND.—The county commissioners have adopted plans for a new bridge over the railway tracks, and also a bridge over the creek, according to reports.

WORTHINGTON, IND.—The county commissioners are considering the question of constructing a steel bridge in place of the wooden structure recently blown down.

ESCANABA, MICH.—It is said that bids have been asked by the county commissioners for a new bridge in Masonville township, over the Whitefish River.

BLOOMINGTON, ILL.—W. P. Butler, Cy. Engr., estimates the cost of a 635-ft. viaduct over the railway tracks at Center St. at $15,000.

SIGOURNEY, IA.—Bids are asked by A. Strauahan until Dec. 18 for building bridges in 1896, according to reports.

ASHLAND, WIS.—It is reported that bids will be received by the McGeehan Construction Co., Ashland, for all pile, bridge and trestle work on the line of the Minneapolis, St. Paul & Ashland R. R., between Ashland and the Duluth, South Shore & Atlantic R. R.

ST. PAUL, MINN.—L. W. Runddett, Cy. Engr., is reported to have been directed to prepare plans for an iron bridge over the railway tracks at Snelling Ave.

TOPEKA, KAN.—Bids are asked by the county commissioners until Dec. 17 for the purchase of $150,000 in bonds for the proposed Melan arch bridge over the Kansas River at Kansas Ave.

KANSAS CITY, MO.—J. A. L. Waddell, Kansas City, Mo., has completed plans for a steel bridge over the Missouri River, to be built on the old piers of the Kansas City & Atlantic Ry. bridge. Each pier is to be cut down 52 ft. The structure will have two spans of 421 ft. each, besides a lift span.

DENVER, COLO.—Bids are asked until Dec. 30 for building a steel bridge over the Gunnison River in Gunnison county, two sureties of $5,000 each, and also for constructing a bridge over the Grand River in Mesa county. H. A. Sumner, State Engr., Capitol Bldg., Denver.

HALLETTSVILLE, TEX.—Bids are asked until Dec. 19 for building an iron bridge over Supple Jack Creek, near Hope, and also for improving two iron bridges. J. W. Rees, Clk. Lavaca county, Hallettsville.

WACO, TEX.—The council has appointed a committee to confer with the commissioners' court with reference to the cost, etc., of the proposed bridge over the Brazos River.

BLAINE, WASH.—It is stated that the county surveyor has been directed to make surveys for a bridge over California Creek, on the Telegraph road.

PORTLAND, ORE.—The O., R. & N. R. R. Co. is considering the question of constructing a new bridge over Hood River.

ASTORIA, ORE.—R. Wakefield and Wm. Jacobson, of Portland, have been awarded the contract for constructing a railway trestle bridge 3,000 ft. long, with a draw over Youngs Bay at this city.

LOS ANGELES, CAL.—C. S. Compton, Cy. Engr., writes us that the bridges over the Los Angeles River at Mary and Alice Sts., to cost $14,170 and $10,600, respectively, and reported in our issue of Nov. 21 as contemplated, will not be constructed the coming year.

BUILDINGS.

BOSTON, MASS.—Hartwell, Richardson & Driver, 62 Devonshire St., Boston, are to prepare plans for a brick addition to the Newton high school building on Walnut St., Newton, Mass. Chn., Henry Tolman, 41 High St., Boston.——The same architects have prepared plans for a school building and dormitories in Hyannis, Mass., estimated to cost $100,000.

BRIDGEPORT, CONN.—Building Inspector Day has completed plans for city hall improvements, which provide for the raising of the roof of the present structure and the remodeling of the exterior. Two new elevators will be put in.

NORWICH, CONN.—Bids are asked by the board of education until Dec. 30 for constructing a new school building on Laurel Hill Ave. Arch., Wilson Potter, 3 Union Square, New York, N. Y.

BINGHAMTON, N. Y.—Bids are asked until Dec. 20 for erecting recreation buildings for the state hospital; two bonds of $20,000 each. I. G. Perry, State Arch., Binghamton and Albany; Alex. Cumming, Chn. Trustees.

BINGHAMTON, N. Y.—Bids are asked until Dec. 23 for making improvements to the military storehouse at Binghamton. I. G. Perry, State Arch., Albany, and Binghamton; Edwin A. McAlpin, Adj. Gen., Albany.

BROOKLYN, N. Y.—Bids are asked until Dec. 20 for constructing a fireproof vault in the municipal building; surety, $2,500. Alfred T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—Bids are asked until Dec. 21 for erecting a 16-room school building on the Mineral Springs Road. R. G. Parsons, Secy. Pub. Wks.——Bids are asked until Dec. 23 for erecting the basement columns, first-floor framing, etc., for the new post office building in this city. Wm. Martin Aiken, Supervising Arch., Washington, D. C.

NEW YORK, N. Y.—Geo. Borgfeldt & Co. have leased from Frederick Southack & Co. the property on Wooster St., between West Third and Fourth Sts., on which it is proposed to erect an 11-story building, 200 × 60 ft.——Hallock & Hohoff, 8 East 42d St., have filed plans for a seven-story brick apartment house at Riverside Drive and 95th St. to cost $160,000.——E. Wenz, 1491 Third Ave., has prepared plans for a $300,000 apartment house and for a $50,000 factory building for F. A. Clark——The New York Realty Co., 54 William St., has filed plans for a 15-story office building at 57 and 59 William St., to cost $500,000.——Harding & Gooch, 253 Broadway, are reported as preparing plans for a $2,000,000 hotel in New Jersey.

NIAGARA FALLS, N. Y.—Block, Barnes & Orchard, Niagara Falls, have prepared plans for a $200,000 brick and stone office building for Beldon & Co., according to reports.

ROCHESTER, N. Y.—The Rochester Ry. Co. is reported as receiving bids for the erection of new car houses.

ATLANTIC CITY, N. J.—Press reports state as follows: Geo. A. Kelly, who is said to represent the syndicate headed by Jacob Rothschild, which owns the Hotel Majestic, in New York, and is backed by the Pennsylvania R. R. Co., appeared before the council Dec. 9 to secure the passage of an ordinance providing for the vacating of two streets which run through the land on which the syndicate proposes to erect a $2,000,000 hotel. Mr. Kelly has given some details of the pro-

...ost, and declares that it is sure to be accomplished if the city will abandon the two streets. The plans for the hotel are similar to the design of the Hotel Majestic, and provide for 1,000 rooms. The ordinance has passed its first reading.

NEWARK, N. J.—It is proposed to construct an eight-story hotel in this city at East Park St. and Park Place, to cost about $600,000, and to be completed by next December. Samuel Klotz, Frederick Frelinghuysen, Gottfried Krueger, John F. Dryden and F. A. Wilkinson, all of whom are members of the Newark board of trade, are interested.

PHILADELPHIA, PA.—Bids are asked until Dec. 16 for plumbing, carpenter work, painting, etc., for the U. S. appraisers' stores. John R. Read, Custodian, Philadelphia.——J. H. Windrim, 1107 Walnut St., Philadelphia, has prepared plans for a three-story brick, marble and granite police station. The building will have a tile roof, iron supports for cells, steel and iron beams and columns, wrought iron gate and grilles, pine finish, electric bells and lighting, steam heating, etc.

PITTSBURG, PA.—Frank McCann, Market St., Pittsburg, and others have purchased a lot at Fifth Ave. and Smithfield St. from J. M. Wilkinson, Wood St., on which it is proposed to erect a large office building.——It is stated that the Pennsylvania R. R. Co. is making arrangements to construct several new stations in this vicinity.

WILLIAMSPORT, PA.—Plans are asked until Jan. 11 for a school building. L. W. Green, Chn. Bldg. Com.

RICHMOND, VA.—Chas. H. Read, Jr., 12 North Ninth St., Richmond, has prepared plans for a $200,000 building for the Hampden Sidney Seminary.

WHEELING, W. VA.—Plans are asked until Dec. 30 for a new county court house, to cost not more than $30,000. James S. Craig, Chn. Com.

JACKSONVILLE, FLA.—It is stated that the county commissioners have asked for plans for a $28,000 armory building. W. F. Coachman, Chn. Com.

MOBILE, ALA.—Bids are asked by the lighthouse board at Washington, D. C., until Jan. 2 for furnishing the necessary material and plant, and for building the different structures for the Mobile Ship Channel lights, as follows: First, the metalwork for a permanent wharf and bridge, beacons, lantern posts, storehouse and dwellings; second, construction of permanent wharf and bridge; third, construction of temporary wharf and bridge; fourth, erection of beacons, lantern posts, and lamphouses; fifth, construction of storehouse; sixth, construction of dwelling house; seventh, furnishing and erecting a gas plant, and eighth, furnishing a steam tugboat for attending the lights, as stated in our advertising columns.

ALGIERS, LA.—L. W. Browne, of New Orleans, is reported as preparing plans for a new $30,000 court house.

BATON ROUGE, LA.—Bids are asked until Jan. 2 for the plumbing, approaches, etc., for the post office building in this city. William Martin Aiken, Supervising Arch., Washington, D. C.

KNOXVILLE, TENN.—The Citizens' Ry. Co. has awarded to Wilkes & Co. the contract for erecting the new car house on Magnolia Ave. Archs., Bauman Bros.

NASHVILLE, TENN.—It is reported that the executive committee of the Tennessee Centennial has conditionally accepted designs for buildings as follows: Commerce, B. J. Hodge & Bro., $30,000; Parthenon, W. C. Smith, $25,000; Transportation, Julius Zwicker, $20,000; Machinery, Gibel & Gabel, $20,000; Electrical, which will be used as an auditorium and not for electrical display, George W. Thompson, $20,000, all being residents of Nashville. Many modifications and changes will be made in the plans in order to make them come within the limit of expenditures. The competitive plans for the next seven buildings are to be confined to Tennessee architects who are not residents of Nashville.

NEWARK, O.—Bids are asked until Jan. 2 for the purchase of 18 bonds of the board of education for improving buildings already erected, and for the erection of new building. H. D. Woodridge, Clk. Bd. Education.

RUSHVILLE, IND.—A. W. Rush & Son, of Grand Rapids, Mich., are reported as having been directed by the county commissioners to prepare plans for a $160,000 court house, the contract for which will be let in March.

TIPTON, IND.—It is stated that plans have been prepared by the Erie Ry. Co. for a new station at this place.

DETROIT, MICH.—Bids are asked by the Goebel Brewing Co., Limited, Rivard and Maple Sts., for the erection of its new brew and wash house. The work will include masonry, cut stone, asphalt, steel and iron, lathing and plastering, carpentery, metal, plumbing, painting and glazing, platform elevator, and copper, tank, millwork and machinery. Arch., Herman A. Brede, Detroit.

DETROIT, MICH.—The following bids were received Dec. 5 for the construction and delivery of the metalwork for the Porte des Morts Range Light tower, Mich., as advertised in Engineering News:

Tacony Iron & Metal Co., Philadelphia, Pa.	$3,182
John P. McGuire, Cleveland, O.	4,250
Allentown Rolling Mills, Allentown, Pa.	4,475
Chamblin, Delaney & Scott, Richmond, Va.	4,894
Snead & Co. Iron Works, Louisville, Ky.	5,294
Russell Wheel & Foundry Co., Detroit.	5,390
Vulcan Iron Works, Chicago, Ill.	5,444
West Point Foundry Co., Cold Spring, N. Y.	7,200
Leonard D. Davis, Erie, Pa.	7,400

CHICAGO, ILL.—Press reports state as follows: Bishop Nicholas has been instructed by the Holy Synod of St. Petersburg to build a cathedral in Chicago, to cost not less than $500,000. It is part of the decree that the sanctuary shall cover an acre of ground; the architecture must follow the established lines of the ecclesiastical forms of Russia, and the general design shall reproduce the St. Vasili of the Kremlin of Moscow. Three locations are under advisement, one near Garfield Park, one opposite Humboldt Park, and the third in the midst of the best residence district of the north side. Harold Julis de Bosse, the supervising architect in the cabinet of the czar, will direct the erection of the cathedral. A Chicago architect has the commission to draft the plans for submission to the synod, with descriptions of material at hand and suggestions for that which ought to be imported.

MENASHA, WIS.—It is reported that plans will soon be asked by the board of education for a new $25,000 high school building. J. L. Fieweger, Supt.

MILWAUKEE, WIS.—Plans are asked until Dec. 23 for remodeling the court house and putting in a steam-heating apparatus. Aug. F. Zentner, County Clk.

MANKATO, MINN.—Bids are asked until Dec. 30 for a heating and ventilating apparatus for the court house and post office building in this city. Wm. M. Aiken, Supervising Arch., Washington, D. C.

HUTCHINSON, KAN.—Local papers state that the county commissioners have appointed an architect to make estimates for a new court house.

HARRISONVILLE, MO.—Bids are asked until Dec. 23 for erecting a county court house; check, $5,000. Arch., W. C. Root, 615 American Bank Bldg., Kansas City, Mo.; T. T. Maxwell, County Clk.

WARRENSBURG, MO.—It is reported that the commissioners of Johnson county will issue $50,000 in bonds for a court house.

WACO, TEX.—A despatch states that a syndicate has been organized, with a capital stock of $5,000,000, which proposes to build hotels at Waco, San Antonio, Rockport, and other points. C. E. Roth, immigration agent of the San Antonio & Aransas Pass R. R. Co. at San Antonio, represents the syndicate.

OLYMPIA, WASH.—Press reports state as follows: The state capitol commission has again rejected all bids for the erection of the new capitol, owing to the provisos in the bids which surround the payment of the warrants. The building is to be erected from the proceeds of the sale of 132,000 acres granted by congress for public building purposes, and the warrants so state on their face. No lands have yet been sold, and the bidders feared the warrants would not always bring par. The bids for this building, which was advertised in Engineering News, were published in our issue of last week. John Keenen, Spokane, Wash., was the lowest bidder at $944,000. Arch., Ernest Flagg, 54 Broad St., New York, N. Y. Edmund Rice, Secy. Capitol Comrs.

SPOKANE, WASH.—Joseph W. Bye, of Spokane, has been awarded the contract for the excavation and foundation work for the new car shops for the Northern Pacific Ry. Co. The contract as let includes the excavating and foundation work for a 22-stall roundhouse; machine shops, 60 × 150 ft.; storeroom, 50 × 100 ft.; woodworking shop, 60 × 300 ft.; also smaller buildings, such as oil, sand, tool and ice houses. Div. Supt., F. W. Gilbert.

SAN FRANCISCO, CAL.—Local papers state that Howard C. Holmes, Ch. Engr. Harbor Comrs., has prepared plans for the proposed long pier light tower for the water front. The lights will have 6,000 c. p., and it is stated that the tower will be 12 ft. square at the base and 29 ft. high, and that the construction will be commenced this week.

MONTREAL, QUE.—It is stated that work will soon be begun by the Canadian Pacific Ry. Co. for a new station and hotel at Craig St. and Viger Square to cost $380,000.

WATER-WORKS.

ACTON, MASS.—Frank L. Fuller, of Boston, has submitted plans for works estimated to cost $97,335. William D. Tuttle, Chn. Bd., Acton Center.

ADAMS, MASS.—The superintendent writes us that an additional water supply will probably be secured in the spring from driven wells.

ATTLEBORO, MASS.—Bids are asked until Dec. 20, according to press reports, for the purchase of $20,000 of 20-year 4% water bonds. Address the town treasurer.

BARRE, MASS.—The town has voted, 82 to 26, to lease the hydrants of the Barre Water Co. for a term not to exceed 10 years at $500 a year, and an additional sum equal to the amount of all taxes assessed, either by the town or state, on the real estate or capital stock of the company. Pres., Dr. Geo. A. Brown.

BOSTON, MASS.—Bids are asked until Dec. 27 for furnishing 48-in. cast iron pipe, as stated in our advertising columns. Frederick P. Stearns, Ch. Engr.; Wm. N. Davenport, Secy., Metropolitan Water Bd.

HATFIELD, MASS.—Bids will be received until Dec. 20, instead of Dec. 27, as advertised last week, for pipe and castings for the new works. E. C. & E. E. Davis, Engrs., Northampton, Mass.

HOUSATONIC, MASS.—T. Z. Potter has been appointed receiver of the Housatonic Water Co., supplying this place and Great Barrington.

NEW BEDFORD, MASS.—Local papers state that the commissioners will soon award the contract for between seven and eight miles of 48-in. force main, from the Quittacus Ponds to the reservoir at High Hill, in Dartmouth. Work on the High Hill reservoir is being pushed as rapidly as possible.

RUTLAND, MASS.—Steps were taken at a meeting last week to secure a water supply. It is stated that a stand-pipe will probably be required.

TAUNTON, MASS.—The water board has recommended an appropriation of $29,000 for the purchase of land around Elder's Pond to protect the water from pollution.

GROTON, CONN.—There is some talk about constructing works to supply this village.

NORWICH, CONN.—It is reported that many of the owners of cottages at Eastern Point are taking steps to obtain a gravity water supply by next year. C. E. Chandler, Engr., of this city, was taken over the ground by A. H. Olmsted, of Hartford, in October.

ARDSLEY, N. Y.—A press report states that the Ardsley Water Co. has been incorporated.

BUFFALO, N. Y.—Bids are asked until Dec. 21 for connecting the new boilers with the present engines, with steam pipe and covering the same. R. G. Parsons, Secy. Dep. Pub. Wks.

CHARLOTTE, N. Y.—P. M. Schwartz, Village Clk., writes us that steps have not yet been taken to construct the proposed works.

MIDDLETOWN, N. Y.—D. S. Seward, Clk. Water Bd., writes us that nothing definite has yet been decided upon in regard to an additional water supply.

PHILMONT, N. Y.—It is reported that surveys have been made for works estimated to cost $38,000, and that the construction will probably be commenced at an early date.

PORT RICHMOND, N. Y.—The trustees have organized a water board.

WEEDSPORT, N. Y.—The Weedsport Water Co. was incorporated Dec. 5 with a capital stock of $30,000; directors, F. C. Reynolds and W. H. Parker, of Moravia, and J. M. Brainard and F. P. Tabor, of Auburn, N. Y.

ATLANTIC CITY, N. J.—The water commissioners are reported as having received bids from five companies for a supply of water meters.

CAMDEN, N. J.—The mayor on Dec. 9 vetoed the contract noted last week as awarded to the Wagner Water Supply Co. for a supply from artesian wells, at $558,000.

WESTWOOD, N. J.—The council has voted to accept an offer of C. S. DeBaun to furnish water for fire purposes at $20 a year, each for 10 hydrants.

ASHLAND, PA.—Frank Lentz, Town Clk., writes us that the council on Dec. 3 instructed the water committee to prepare plans and specifications for the proposed new dam, but that at the time of writing, Dec. 6, no engineer had been appointed.

HAVERFORD, PA.—The press report in regard to water-works at Haverford, Pa., noted last week, we are informed, did not refer to the township having a postoffice address of this name. This town is already supplied by the Haverford Water-Works Co., and the Bryn Mawr Water Co., and no steps are being taken to construct new works.

KENNETT SQUARE, PA.—The council is reported as about to purchase a new engine and pump. The Coatsville Boiler Works is now erecting a stand-pipe. The improvements will possibly cost about $5,000.

NEWVILLE, PA.—The council is reported to have signed a contract with N. C. Freck and others, of Millersburg, Pa., to construct works, the plant to be completed by June 1.

PHILADELPHIA, PA.—The following bids were received at Washington Dec. 3 for drilling an artesian well and the supplying and installation of pumps, steel tower and a covered steel storage tank in connection with the League Island navy yard: Manhattan Supply Co., New York, entire work complete, $6,211 if deep well pump is used, and $6,111 if duplex fire pump is used; $8.85 per foot for drilling well. Waring Prindle Pump Co., 126 Liberty St., New York, $9,000 (informal), bid according to bidder's specification.

READING, PA.—Emil L. Nuebling, Supt. and Engr., writes us that no extensive improvements are contemplated at present, and that such work is usually done by the department. Bids will be asked within a few months for supplies.

WILKES BARRE, PA.—The Prospect Rock Water Co. was incorporated Dec. 9 with a capital stock of $10,000, commencing with $1,000, to supply water in the borough of Laurel Run; Thos. M. Mayler, Laurel Run, Luzerne county, Pa.

YORK, PA.—The York Water Co. is reported to have purchased 117 acres of land at a cost of $25,000 as a site for a new reservoir.

FRANKLIN, PA.—W. T. Pace, Recdr., writes us that J. P. Gay and J. R. Knight have been appointed a committee on construction of new works; population, 1,500.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Jan. 10 for furnishing and erecting an 8,000,000-gallon pumping engine, as stated in our advertising columns.

DELLSLOW, W. VA.—It is stated that this place will soon have works, the water supply being from a spring near the town.

CHARLOTTE, N. C.—The aldermen have ordered an election to be held Feb. 18 to vote on an issue of $300,000 of 5% bonds. Our correspondent writes us that it is proposed to purchase the present plant and spend the balance, about $150,000, for extensions, and that there is little doubt but that the proposition will carry. Engr., J. L. Ludlow, of Winston, N. C.; Mayor, J. C. Weddington.

DURHAM, N. C.—We are informed that public sentiment is strongly in favor of municipal works, and that it is probable the present plant will be purchased and enlarged, or a new plant constructed at an early date. T. L. Peay, Mayor.

RALEIGH, N. C.—The state penitentiary authorities are considering the practicability of boring artesian wells or taking other steps to secure an adequate water supply on the three state farms, where over 1,000 convicts are at work. Address A. Leazar, Supt. State Penitentiary, Raleigh.

UNION, S. C.—A committee is reported to have been appointed to secure information in regard to a water-works plant.

PORT GIBSON, MISS.—Thos. M. Rea, Cy. Clk., writes us that the water-works proposition was defeated at the election Dec. 2.

DYERSBURG, TENN.—A mass meeting was recently held to consider the question of granting P. Shepard, who owns the present works, an additional franchise for the purpose of extending the works.

NEWPORT, KY.—Bids are asked until Dec. 16 for the building and erecting of a battery of two steam boilers, 72 ins. diameter of shells, each boiler to have 96 6-in. tubes, 20 ft. long, riveted to heads. John Surran, Supt.

PROVIDENCE, KY.—A press report states that the residents of this place want water-works.

DELPHOS, O.—The plans and specifications for works have been completed and adopted by the village council. An election of trustees will be held Dec. 23, and it is expected that the letting of the work will occur the latter part of January. R. H. Gamble, Consult. Engr., Lima, O.

NEWARK, O.—William A. Veach, Supt., has been appointed receiver of the plant in this city. It is stated that the works will probably be appraised and purchased by the city.

EVANSVILLE, IND.—Delaney & Dawson, of Cincinnati, were the lowest bidders Dec. 5 for constructing pump well, etc., as advertised in Engineering News, at $84,500 for the well and $24,500 for the intake pipe. Eichel, Arnold & Co., of Evansville, who were the lowest bidders at a previous opening of bids (bids published Oct. 24) bid $90,547 and $31,000, respectively.

INDIANAPOLIS, IND.—The citizens of Woodruff Place are agitating the construction of an independent water-works plant. It is stated that the town owns all

of the mains, and yet pays the water company about $3,000 a year. It is thought that a stand-pipe can be erected and a water supply obtained from driven wells at a small cost.

LEAVENWORTH, IND.—The board of trustees is reported as making arrangements for the construction of works.

SULLIVAN, IND.—Fred Hoke, Clk., writes us that no steps for works have been taken since the recent election.

ASTORIA, ILL.—H. E. McLoren writes us that the election resulted favorably, and that bonds will be issued in the spring. The supply will be from a well 1,200 ft. deep.

DWIGHT, ILL.—Julian Barnes & Co., 935 Marquette Bldg., Chicago, are reported to have prepared plans for a water tower and stand-pipe 100 ft. high, to be constructed at this place by J. R. Oughton.

FREEPORT, ILL.—A committee has been appointed by the council to get an option on the water-works, with a view to purchase by the city.

RIVERSIDE, ILL.—Bids are asked until Dec. 23 for excavating, etc., for extensions of the works, as stated in our advertising columns. Thos. T. Johnston, Consult. Engr., Rialto Bldg., Chicago; J. J. Amsden, Village Clk.

SPARTA, ILL.—A press report states that the proposed works will probably cost $24,000.

SHELBYVILLE, ILL.—W. H. Sliver, Clk., writes us that no contracts have yet been awarded, and it is not probable that anything will be done this winter.

TURNER, ILL.—Bids are asked until Dec. 14 for boring a well, and until Dec. 28 for constructing works, which reports state will consist of 22,500 ft. of 6-in. pipe, 2,000 ft. of 8-in. pipe, a water tower 115 ft. high, a reservoir, pumping engine, etc. T. G. Isherwood, Chn. Com.

UPPER ALTON, ILL.—The proposition of Geo. C. Morgan, of Chicago, to construct a $53,000 plant is said to have been accepted and a franchise granted to the Upper Alton Water-Works Co., noted last week as incorporated to construct the works.

EDGERTON, WIS.—The "Reporter," of this city, urges that steps be taken to secure works.

EAU CLAIRE, WIS.—At a meeting of the council, Dec. 4, a resolution was passed requesting C. A. Alderman, Cy. Engr., to make an estimate of the cost of the works, owned by a private company, and submit a report at the next regular meeting of the council. The city is investigating with a view of purchasing.

UNION GROVE, WIS.—E. W. Treat, Clk., writes us that it is not probable that works will be constructed for several years.

AMES, IA.—The trustees of the agricultural college have asked for an appropriation of $35,000 to $40,000 for a water supply. A contract was recently awarded for sinking a deep well.

ANAMOSA, IA.—A Chicago firm is reported to have been awarded a contract to sink a well, 1,400 ft. deep, at the prison at $2 a ft.

KEOSAUQUA, IA.—James P. Starr, Cy. Recdr., writes us that a proposition to issue $10,000 in bonds will probably be voted upon about March 1. A committee has been appointed to investigate the question of works, but no report has yet been made.

DULUTH, MINN.—Local papers state that the city clerk has been directed to advertise for bids for the pipe and fittings for the new intake, and that the work will require about 1,000 ft. of 5-ft. riveted steel pipe, and will cost about $20,000.

SLEEPY EYE, MINN.—At an election Dec. 3 a proposition to issue $5,000 in bonds for water-works and electric lights was defeated by five votes.

EVEREST, KAN.—John Lyons writes us that the town has given up the water-works project at present.

FAIRBURY, NEB.—It is reported that the water and light plant is to be enlarged.

FARGO, N. DAK.—S. P. Kelley, Supt., writes us that the $12,000 in bonds recently voted will be used next season in laying about six miles of extensions. The work will probably be done by day labor, under the direction of a superintendent.

GRANT CITY, MO.—It is reported that specifications for works are about completed. J. S. Hagen, Engr.; S. C. Davidson, Cy. Clk.

KIRKWOOD, MO.—The Meramec Highlands Improvement Co. is reported to have accepted the franchise recently granted for works at this place. Pres., Marcus Bernheimer.

TRENTON, MO.—It is reported that the new company that recently acquired the works has appropriated $3,000 for sinking a well, and that other improvements are contemplated.

UNIONVILLE, MO.—Bids are asked until Jan. 10 for plans and specifications, and also for boring and casing a 6, 8 or 12-in. well; entire cost of water-works and electric light plant not to exceed $18,000. G. H. Gardner, Cy. Clk.

CRIPPLE CREEK, COLO.—It is reported that a new reservoir, 140 × 65 ft., 17 ft. deep, and covered with a corrugated iron roof, will be constructed as soon as the weather will permit.

IDAHO FALLS, IDAHO.—It is expected that an election will soon be held to vote on an issue of bonds for a water-works and electric light plant.

KALAMA, WASH.—The Orchard Water Co. has been incorporated with a capital stock of $7,000, by H. Orchard, J. P. Atkin and A. H. Imus. The granting of a franchise to H. Orchard was recently noted.

TACOMA, WASH.—The Oregon Mining & Water Supply Co., of this city, has been incorporated, with a capital stock of $20,000, by W. H. Jennings, J. T. Redman and G. F. Shaw.

IRRIGATION.

FULTON, S. DAK.—It is stated that C. B. Fisher, of Aurora, who owns land 1½ miles north of this place, is considering the question of sinking an artesian well on his property for irrigation purposes. Frank Van Wagenen is the agent.

OGALLALA, NEB.—Bids are asked until Dec. 23 for the purchase of $21,500 of 6% irrigation bonds of the Alfalfa Irrigation District. H. C. Anderson, Secy., Ogallala.

FORT COLLINS, COLO.—The Terry Lake reservoir, belonging to the Larimer & Weld Reservoir Co., and located near this place, has been enlarged so as to be capable of holding 5 ft. more of water. Constr. Engr., Ray Walters, of Fort Collins.

STERLING, COLO.—The Pawnee Pass Reservoir Co. has surveyed a line for a feeder to a large reservoir site near this place. The site covers some 6,000 acres, with a dam 100 ft. in height.

BLACKFOOT, IDAHO.—Press reports from Washington, D. C., state as follows: The commissioner of Indian affairs is about to make another effort to have the Fort Hall, Idaho, reservation irrigated, so that it may be of some use to the Indians as farm land. He has prepared an advertisement, which is to be sent out in a short time, calling for proposals for constructing ditches and furnishing water to the occupants on the land. The specifications call for the construction of ditches from the Snake River to the Blackfoot River, crossing the latter by a flume, and furnishing about 300 cu. ft. of water between Blackfoot River and Ross Fork Creek, and a like quantity of water between Ross Fork Creek and Port Neuf River. There is some $90,000 on hand with which to perfect the irrigation project already partially completed by the Idaho Canal Co.

SALINA, UTAH.—It is reported that the Salina Creek Irrigation Co. has made surveys for a new dam about four miles east of the town, work on which will probably be begun in the spring.

NEW COMPANIES.—Seguim Prairie Ditch Co., Seguim Prairie, Clallam county, Wash.; $5,000; J. W. Grant, Thomas Miller, C. P. Donnell.

Orchard Water Co., Kalama, Wash.; $7,000; H. Orchard, J. P. Atk'n, A. H. Imus.

Oregon Mining & Water Supply Co., Tacoma, Wash.; $20,000; Wallace H. Jennings, J. T. Redmond, G. F. Shaw.

Extension Ditch Co., Weiser, Idaho; $25,000; G. V. Nesbit, J. C. Carroll, C. T. Craven, E. M. Barton, Weiser; Michael Skeffington, Payette, Idaho.

Weiser Reservoir, Land & Irrigation Co., Weiser, Idaho; $100,000; J. W. Ayers, Cary A. Tush, Carrie Ayers, Weiser; J. H. Holmes, of Ogden, Utah; H. M. Jarvis, Kansas City.

Brazos & Wichita Irrigation Co., Wichita Falls, Tex.; $600,000; M. Lasker, Galveston, Tex.; W. F. Flood, J. A. Kemp, Wichita Falls; Morgan Jones, Fort Worth, Tex.; G. M. Dodge, New York, N. Y.; J. A. Bushnell, Sam Bellah, W. S. Edwards, J. H. Glasgow, C. J. Green.

SEWERAGE.

ARLINGTON, MASS.—Bids are asked by the sewer commissioners until Dec. 28 for furnishing about 61,048 ft. of 18 to 4-in. sewer pipe, as stated in our advertising columns. Engr., Geo. A. Kimball, Exchange Bldg., Boston, Mass.

CAMBRIDGE, MASS.—It is stated that L. M. Hastings, Cy. Engr., has recommended the construction of a new system in the district about Sydney and Allston Sts.

GARDNER, MASS.—An election is to be held in North Gardner Dec. 14 to vote on the question of appropriating money for sewers and streets, according to reports.

STONEHAM, MASS.—At a town meeting, held Dec. 6, it was voted to authorize the sewer commission to petition the legislature for permission to construct a system 25¼ miles long, at an estimated cost of about $250,000. It is probable that only half this system will be built at present. Stephen P. Finnegan, Chn. Comm.

WEBSTER, MASS.—Lucian A. Taylor, 21 Lancaster St., Worcester, writes us that a system 16 miles long has been designed for this city, and probably a portion of it will be constructed next year.

NEW YORK, N. Y.—Bids are asked until Dec. 21 for constructing sewers in 22 streets in wards 23 and 24, and for granite block paving in 141st St. Louis F. Haffen, Comr. St. Improvements, 2622 Third Ave.

ROCHESTER, N. Y.—John Y. McClintock, Cy. Engr., is preparing specifications for a tunnel sewer 300 ft. long and about 6 × 4 ft. in size, from Central Ave. and Water St., to empty into the lower river at the Rochester Power Co.'s plant. The sewer will be from 80 to 100 ft. beneath the ground, and will take the overflow from the Central Ave. sewer. It is said that work will be begun this winter.

SANDY HILL, N. Y.—D. J. Sullivan, Clk. Bd. Sewer Comrs., writes us that the plans for a complete system are not yet completed, but probably will be in a few days. Engr., John W. Burke, 45 Broadway, New York.

SAUGERTIES, N. Y.—The question of constructing a sewer system is being discussed.

SYRACUSE, N. Y.—Bids are asked until Dec. 16 for brick and pipe sewers in certain streets. H. F. Stephens, Cy. Clk.

TROY, N. Y.—The city engineer has been directed to prepare plans for a sewer in Walnut St., and also a private sewer in Cragin Ave. Martin Schenck, Cy. Engr.

WAVERLY, N. Y.—F. E. Hawkes, Village Clk., writes us that nothing will be done in connection with the proposed sewage disposal plant and sewer system until spring.

BRIDGETON, N. J.—It is stated that a sewer company has been organized. Pres., George W. Ireland; Secy., Wm. H. Halnsworth; Treas., Edward B. McIntyre. Application for a franchise will be made at the next meeting of the council.

ELIZABETH, N. J.—Bids are asked until Dec. 26 for constructing 1,900 ft. of 54 to 30-in. brick sewer in Bayway St. N. K. Thompson, St. Comr.

KANE, PA.—It is proposed to issue bonds for extending the main sewer 5,500 ft. Joshua Davis, Burgess.

YORK, PA.—The highway committee has approved an ordinance for extending sewers in four streets, according to reports.

BALTIMORE, MD.—Bids are asked until Dec. 19 for furnishing the drip and covering stones for sewer inlets during 1896. Janon Fisher, Cy. Comr.

WASHINGTON, D. C.—The Mount Pleasant Citizens' Association is discussing the question of better sewers in that portion of the district. Pres., J. W. Somerville. ——A bill has been introduced in the senate for extending the trunk sewers.

MOBILE, ALA.—Bids were opened Dec. 2 for constructing a sewer system, as advertised in Engineering News. No arrangements have been made for paying for a system and no contracts will be awarded, until the question has been thoroughly investigated. The bids were submitted on different plans and for 17 to 90 miles of sewers. A. S. Bean and Robt. Hunter submitted a petition for a franchise, the following bidding on the construction of a system: Brownell Improvement Co., of Chicago; Herbert L. Tate, of New York; J. E. Riley & Co., of Omaha, Neb.; H. M. Nelson, of Chicago; D. Delany & Co., of Buffalo, N. Y.

PIQUA, O.—Bids are asked until Dec. 30 for constructing sewers. Seth McColloch, Cy. Clk.; H. L. Whitlock, Cy. Engr.

ESCANABA, MICH.—We are informed that Jas. B. Moran, of this city, has been awarded the contract at $1,165 for the construction of 1,200 ft. of 8-in. sewer outlet, by the building committee of the board of supervisors of Delta county, to extend the outlet of sewer from the Tracy hospital. Engr., D. A. Brotherton, 810 Charlotte St., Escanaba.

ROCHESTER, MINN.—It is stated that bids have been asked for constructing 4,250 ft. of lateral sewers, to be constructed partly this year and the remainder in the spring; besides this about 10,000 ft. of pipe sewers will be built next summer. Engr., Wm. C. Fraser.

KANSAS CITY, MO.—H. H. Filley, Cy. Engr., has recommended the construction of an intercepting sewer 86 to 63 ins. in diameter, from Belt Line Ave. to the water-work station at Turkey Creek, which will empty into the Missouri River at this point, estimated to cost $65,000; a pumping station will also be erected at the outlet, making the entire system cost $200,000.

ST. LOUIS, MO.—Bids are asked until Dec. 20 for constructing 1,320 ft. of 15 to 12½ ft. brick and concrete sewer for Tower Grove, and 19,920 ft. of 9 to 2-ft. brick sewers and 94,160 ft. of 24 to 12-in. pipe sewers. We are informed that 18,627 cu. yds. of brick sewers will be required. The entire work is estimated to cost $246,400. Robert E. McMath, Pres.; Emory S. Foster, Secy. Bd. Pub. Improvements; B. H. Colby, Sewer Comr.

ATCHISON, KAN.—It is stated that the city authorities have ordered advertisements for bids for constructing a sewer to cost $75,000.

BENICIA, CAL.—Bids are asked until Dec. 18 for constructing a sewer system at Benicia Barracks; A. S. Kimball, Ch. Q. M. Gen., U. S. A., San Francisco.

SANTA ROSA, CAL.—The council is considering the question of constructing a main sewer 16 miles long to tidewater, according to reports.

SALT LAKE CITY, UTAH.—The secretary of war has been petitioned to improve the sewer system of Fort Douglas. Address, Frank Cannon.

HAMILTON, ONT.—Emil Kuichling, Rochester, N. Y., is reported to have made the following estimates for various systems of sewage disposal for this city: Broad irrigation, including a 760-acre farm east of the city, $630,000; intermittent filtration, $602,000; chemical precipitation, $783,000, and depositing into deep waters of the bay, by gravitation and pumping, $326,000. The last-mentioned system is the one Mr. Kuichling has recommended. The cost is made up as follows: Buildings, $28,000; pipes, $60,000; land, $5,000; intercepting conduit system, $135,000; cost of operation capitalized, $98,000. This system will be good for ten years, and if at the end of that time the bay shows signs of pollution a system of rapid filtration could be attached at a small cost. It is suggested that the first work to be done be the diverting of the east end sewer. Wm. Haskins, Cy. Engr.

STRATFORD, ONT.—It is stated that Alan Macdougall, Engr., Toronto, is considering plans for extending the system.

WELLAND, ONT.—The provincial board of health at Toronto has been considering plans for extending the sewer system of this place, according to reports.

GARBAGE DISPOSAL.

NEW YORK, N. Y.—Only one bid was received Dec. 10 for final disposition of street collections, garbage and ashes by other means than dumping them in the sea, a practice which the secretary of war has ordered to be discontinued on April 1. This came from Zeph. F. McGill, of Troy, who offered to do the work for five years at $306,000 a year. The bid was defective in that Mr. McGill offered only one surety, while the law required two. Mr. McGill is the contractor for disposing of the refuse of Troy by cremation. Contractors who were present when the bid was opened are reported to have said that they had refrained from bidding because they regarded the conditions too severe. It is understood that a company which put in no bid has for some time had an offer pending for the commissioner promising to remove all the street collections, garbage and ashes at $300,000 a year.

LANCASTER, PA.—Dr. M. L. Davis has submitted a proposition to erect a garbage crematory and collect and cremate all the garbage of the city for a term of years, the city to have the privilege of purchasing the plant at its actual cost at the end of five years. A proposition to issue bonds for a garbage crematory was defeated some time ago by those opposed to increasing the bonded indebtedness of the city, but it is stated that popular sentiment is strongly in favor of garbage cremation.

READING, PA.—Edward Chamberlain, Cy. Engr.; H. H. Hammer, Cy. Clk., and other city officials, were in Pittsburg last week getting additional information in regard to garbage crematories.

STREETS AND ROADS.

BOSTON, MASS.—Bids are asked until Dec. 13 for 27,000 cu. yds. of earth and 1,000 cu. yds. of rock excavation, etc., in connection with grading Blue Hill Ave. B. T. Wheeler, Supt. Sts.

GARDNER, MASS.—An election is to be held Dec. 14 to vote on the question of appropriating money for paving and sewers.

STAMFORD, CONN.—Bids are asked until Dec. 21 for county road work from Greenwich to Stamford. E. S. Holly, Selectman, Stamford.

BROOKLYN, N. Y.—The Good Roads Association has decided that Glenmore Ave. should be improved as a means of connecting the Eastern Boulevard with the macadam roads of Queens county. At present Glenmore Ave. is paved with granite blocks, and the question is now being considered as to whether asphalt, brick or macadam is to be used for repaving the avenue.

ROCHESTER, N. Y.—The Warren-Scharf Asphalt

Paving Co. was the lowest bidder for paving in Rutger St., at $10,925; estimated cost, $13,500

ROCHESTER, N. Y.—It is proposed to pave portions of two streets with asphalt, at a cost of about $52,000; grade and macadamize two streets, at a cost of $7,000, and construct a sewer in Field St. and Monroe Ave., at a cost of $17,000. Theo. S. Culver.—It is stated that John Y. McClintock, Cy. Engr., is preparing plans for macadam and Medina stone paving in Mount Hope Ave., estimated to cost $65,000.

SYRACUSE, N. Y.—Bids are asked until Dec. 16 for paving in certain streets. H. F. Stephens, Cy. Clk.

ATLANTIC CITY, N. J.—The council has directed the city surveyor to make surveys for the new esplanade. It is proposed to build 2,000 ft. on steel frames, at an estimated cost of about $45,000.

NEW BRUNSWICK, N. J.—Wm. Hardgrove, of Somerville, N. J., and H. S. Wilson, of New Brunswick, have been awarded the contracts, at 68 cts. per sq. yd. and 67½ cts., respectively, for constructing a macadam road from Stelton to Dunellen, six miles, and from Spotswood to Old Bridge, 13,076 ft. John F. Ten Broeck, Chn. Bd. Comrs., New Brunswick.

NEW ORLEANS, LA.—The question of paving Canal St., from Magazine to Claiborne St., with asphalt is being discussed.

CLEVELAND, O.—The council has received the following bids for grading and paving in Superior St.: W. J. Gawne, $8,579; Shields & Lauer, $9,151; The Northern Ohio Paving & Construction Co., $9,206; L. & J. F. Brennan, $9,981; M. F. Bramley, informal; Albion Stone Co., informal. Samuel G. McClure, Secy.

MANSFIELD, O.—Bids are asked until Dec. 21 for improving two streets. F. M. Remy, Cy. Clk.

SPRINGFIELD, O.—It is stated that the city clerk has been instructed to advertise for bids for grading six streets and constructing a sewer in Harrison St.

DETROIT, MICH.—Thos. M. Campau has made surveys for a new boulevard.

SAGINAW, MICH.—The council will soon begin to make arrangements for letting contracts for asphalt, cedar block or brick paving in 10 streets, at an estimated cost of $125,000. The work will be done in the spring, although the contracts will probably be awarded in the winter.

CHICAGO, ILL.—The west side park commissioners are considering the question of constructing Jackson St. into a boulevard to Michigan Ave., at an estimated cost of about $300,000.

WACO, TEX.—T. H. Brown, County Clk., Waco, writes us that the county commissioners have ordered an election to be held to vote on the question of improving the roads of McLennan county.

SPOKANE, WASH.—W. H. Wiscombe, St. Comr., writes us that there have been no definite steps yet taken towards any paving of Riverside St., but it is hoped the property owners will consent to pave a few blocks in the spring. Any opinions or information received will be considered.

SAN FRANCISCO, CAL.—The supervisors are to be petitioned to construct a macadam boulevard from the Palace Hotel, Market St., to the Presidio. A. B. Spreckels, Chn. St. Improvement Com., Bd. Supervisors, San Francisco.

MANUFACTURING PLANTS.

EASTPORT, ME.—Press reports state that of the $15,000 needed to secure the building of a factory at this place, subscriptions to the amount of $11,000 have been received.

UNION, ME.—I. C. Thurston is in Massachusetts trying to secure the location of a factory in South Union.

WOODFORDS, ME.—It is stated that W. W. Mitchell will rebuild his factory in the spring.

MILFORD, N. H.—It is reported that the management of the Hillsboro Mills will erect a new mill 260 × 70 ft., three stories high. New looms will be needed.

NEW LONDON, N. H.—About $6,000 has been subscribed for the proposed new shoe factory.

BOSTON, MASS.—A party of Eastern capitalists, including George A. Denham, Gen. Man., and the directors of the American Palace Car Co., are inspecting different localities in the central and southern states with a view of locating a plant for the manufacture of cars.

STOUGHTON, MASS.—It is understood that Charles Stratton & Sons, manufacturers of woolen and worsted goods, are to build an addition, 30 × 26 ft., three stories high.

TAUNTON, MASS.—An exchange states that the Corr Mfg. Co. has been organized with a capital stock of $400,000. The company has bought a large tract of land in East Taunton, upon which it will erect a fancy goods cotton mill of 40,000 spindles, and as soon as this mill is in operation No. 2 mill will be started upon. Treas., W. H. Shumway.

WILKINSONVILLE, MASS.—It is reported that E. E. Clark has resigned as machinist for the Manchaug Co., and is to superintend the erection of the Slater's new mill in this place.

BRIDGEPORT, CONN.—A press report states that the Chaquette Power Co. has purchased an extensive tract of land on Crescent Ave., and will soon erect a large plant for the manufacture of compressed air, machines for the manufacture of ice, also several other designs of compressed air machinery. Capital stock, $75,000. The company is composed of Ephraim Chaquette and attorneys Davenport and O'Hara.

HARTFORD, CONN.—The E. H. Jacobs Mfg. Co. is building an addition to its block on School St. New machinery is to be added.

MIDDLETOWN, CONN.—It is stated that the L. D. Brown & Sons Co. is about to build an extension to its silk factory.

NEW BRITAIN, CONN.—According to press reports the New Britain Knitting Co. will soon erect a new building, in which will be placed three new boilers, fire pump and water heaters.

NEW HAVEN, CONN.—A news item states that the Eastern Mfg. Co. will erect a brick factory at the corner of Ashmun and Gregory Sts.

STONINGTON, CONN.—E. E. Bradley is reported as contemplating the erection of a silk mill in the South, but has not yet decided upon the location.

AMSTERDAM, N. Y.—Becker, Lindsay & Nolan, owners of the carding and picking mill in the old Carmichael malt house, are reported as having purchased a site, on which they will erect a large plant at once, giving employment to 125 persons.

CORTLAND, N. Y.—Lester Cooper, of Cooper Bros., has stated that it is his intention to rebuild early in the spring the foundry and machine shop, which were destroyed by fire, as noted in our columns last week.

MALONE, N. Y.—It is stated that the Lawrence Mfg. Co., recently incorporated with a capital stock of $50,000, will erect a 20-ton pulp mill on the Salmon River, 13 miles above this city; and that lower down the stream a paper mill will be erected. W. J. Semper, of Watertown, has charge of the mills and the erection of the buildings.

MOUNT VERNON, N. Y.—The planing and woodworking mills of the D. G. Burton Lumber Co. were recently burned; estimated loss, $50,000; insurance, $16,000. Wm. Chambers is superintendent of the company.

CHESTER, PA.—J. Willard Hoopes, of Lansdowne, is reported as having the contract for building a three-story factory, 40 × 75 ft., for the Stanton Mfg. Co., at Paschalville.

CLIFTON HEIGHTS, PA.—Wm. J. Thompson, has commenced rebuilding on the site of the buildings which were burned. The new structure will be two stories, brick, 40 × 80 ft., with boiler and engine house attached.

JOHNSTOWN, PA.—A report states that a new manufacturing company, with J. H. Moxham, of Lorain, O., Pres., and T. C. Dupont, of the Johnson Co., Gen. Man., at the head, has been organized, and will at once apply for a charter. The company proposes to manufacture ice machines at the Johnson Co.'s works. Another report states that an electric motor company, to employ 400 men, will probably locate in the portion of the Johnson Steel Co.'s works that were last year abandoned.

McKEESPORT, PA.—Press reports state that the National Galvanizing Works, at this place, will be removed at once to the free site granted the company in Versailles. About 300 men will be employed in the remodeled plant. The ground thus vacated has been purchased by the National Tube Works, and will be utilized in making extensive additions to their plant.

McKEES ROCKS, PA.—It is reported that D. R. Speer & Co., of Duquesne Way and Third St., Pittsburg, have purchased 8½ acres at this place, on which they will build, at once, extensive hardwood furnishing and box factories.

NEW BRIGHTON, PA.—The Glenn Driller Co. is preparing plans for a new factory to be erected next spring, according to press reports.

PHILADELPHIA, PA.—It is stated that the Powelton Electric Co. will build a one-story boiler room, 19 × 42 ft., at 45th St. and Baltimore Central R. R.—Reports state that work has been started on a large knit goods factory for the Pilling Mfg. Co., corner of Trenton Ave. and Ann St., to be three stories, 50 × 210 ft., with a wing 27 × 48 ft. A one-story boiler and dye house will also be erected.—It is stated that Thomas Grieves will soon begin work on a two-story silk factory at 709 Tasker St.

PHOENIXVILLE, PA.—Byrere, Parsons & Co. are to erect a mill 120 × 46 ft., three stories and basement, with boiler house 20 × 46 ft. An 80-HP. boiler, a 60-HP. engine, 100-light electric generator, freight elevator, tank, etc., will soon be purchased.

PITTSBURG, PA.—The Carborundum Co. will build a new oven house, 50 × 100 ft., of steel and brick, to be located at Niagara Falls. T. D. Evans is the architect in charge.

STEELTON, PA.—Press reports state that Messenger Bros., marble cutters, will erect an establishment for stone cutting on Swatara St. next year.

POWHATAN, MD.—The Powhatan Mill, eight miles northwest of Baltimore, was recently destroyed by fire. The building was owned by the Powhatan Improvement Co., of which A. M. Rouldin is president; loss, between $65,000 and $70,000; insurance, $35,000.

WASHINGTON, D. C.—Stilson Hutchings will, according to press reports, erect a boiler and engine house room in connection with the proposed skating ring at Convention Hall.

NORFOLK, VA.—A charter is being prepared for the Norfolk Brewing Co., which proposes to expend $150,000 in the erection of buildings and equipments. Several sites are now under consideration. C. A. Strangmann will be the manager of the new brewery, and Judge D. Tucker Brook is preparing the charter.

FAYETTEVILLE, N. C.—Ex-Gov. Thomas M. Holt, of Haw River, N. C., and the firm of W. Duke, Sons & Co., Durham, N. C., will build a cotton bleachery at this place, to cost in the neighborhood of $1,000,000.

HILLSBORO, N. C.—The Farmers' Alliance of N. C. have bought buildings at this place, where they will establish at once a tannery and shoe manufactory, and later on several other manufacturing plants.

LEAKSVILLE, N. C.—A new mill will probably be erected at this place, at a cost of $200,000, according to press reports. M. R. Walker, Treasurer of the Leaksville Cotton Mills, is interested.

NORTH WILKESBORO, N. C.—C. C. Smoot & Sons, of Alexandria, Va., will remove their tannery to this place, where they will establish a $100,000 plant, being much larger than the present one.

SHELBY, N. C.—A. C. Miller, of this place, and R. M. Oates, of Charlotte, are planning the erection of a spinning mill to contain 10,000 spindles.

WILMINGTON, N. C.—It is reported that the Wilmington Cotton Mills have about completed an addition in which will be put 60 new four-box dobby looms.

CHERAW, S. C.—It is stated that John T. McNair and W. H. Willard, of this city, have leased a building at Norfolk, Va., and will put in machinery for manufacturing children's hosiery. The outfit will cost about $12,000, and 100 hands will be employed.

FAIRFIELD, S. C.—D. A. Tompkins, of Charlotte, N. C., and W. C. Beatty, T. W. Lauderdale and associates will build a cotton mill, to cost $65,000, at this place.

ROME, GA.—A movement is on foot for the erection of another $600,000 cotton mill in this city, and a proposition has been made by Northern capitalists for securing same. J. L. Bass, J. H. Reynolds, J. W. Rounsaville and others are interested.

BIRMINGHAM, ALA.—James B. Cotton and J. H. Gary, of Chester, Pa., and James E. Webb, of this city, have incorporated the Birmingham Cotton Mfg. Co., with a capital stock of $150,000. Messrs. Cotton and Gray are removing one of their chief mills here, and will make this city their chief place of business in future. It is also stated that they have declared their intention to build several more mills in Alabama.

CHATTANOOGA, TENN.—A movement is on foot to establish a machine shop where bridge building and the tools used will be the chief object of manufacture. Address James R. De Long, of Highland Park.

MOUNT AIRY, TENN.—Current report states that the Mount Airy Woolen Mills, which were burned last summer, are to be rebuilt, and that W. S. Alfred and A. G. Trotter have formed a co-partnership for said purpose.

KENTON, O.—A press report states that the Champion Iron Co., of Kenton, will put in a complete plating equipment. Pres., D. J. Carter.

CLINTON, O.—A press report states that a Lima, O., manufacturer asks Clinton people to subscribe $10,000 worth of stock to secure a pump factory which he wants to start somewhere in Illinois.

SANFORD, IND.—It is understood that J. J. Bolton will erect a factory building, 30 × 48 ft., four stories, brick, with an engine house, 26 × 30 ft., two stories, and a boiler house, 20 × 30 ft., one story. A Corliss engine, 14 × 30 ins., will be required. No contracts for steam plant have yet been closed, except for the boilers.

HANCOCK, MICH.—The Franklin engine and boiler house was recently destroyed by fire. It is stated a new boiler house, 65 × 55 ft., separate from the engine house, will be built.

CHICAGO, ILL.—A report states Adams & Westlake, corner North Franklin & Ontario Sts., will erect a seven-story and basement manufacturing building, 100 × 120 ft., corner Ohio and Market Sts., to cost $75,000. Electric lighting, freight elevators, etc., will be put in. Arch., E. M. Bent, 339 Rookery.

TURNER, ILL.—It is stated that the Thomas Bradshaw Shoe Co., incorporated with a capital of $25,000, all paid in, will erect a factory here, and employ 100 hands.

JANESVILLE, WIS.—A stock company is reported as having been organized to manufacture threshing machines in the old Hansen factory. The Business Men's Association has charge of the matter.

MINNEAPOLIS, MINN.—It is reported that the Sheotin Carpenter Co. will build another sawmill this winter at an estimated cost of $40,000.

DES MOINES, IA.—The Des Moines Union Ry. will erect shops at 13th and Cherry Sts., at a cost of $35,000. There will be four brick buildings, which will be equipped with modern machinery.—It is stated that Newman Bros. will put in a brick plant, five miles east of Des Moines, and that $40,000 will be expended for machinery.

ST. LOUIS, MO.—It is understood that the American Aluminum Co., 407 North Broadway, will build extensive additions to its works, located at Fairlawn.

DALLAS, TEX.—It is stated that the big print mill, to be built by Southern capitalists in this city, will be capitalized at $1,000,000. David Trainer, of Fort Mill, S. C., is representing the interested parties, and a suitable location for the mill is now being sought. It is proposed to install an equipment of 30,000 spindles and 1,000 looms.

BOULDER, COLO.—Thomas Holland, of Bremen, Ind., is consulting with the citizens of this place regarding the erection of a foundry to cost $25,000.

DENVER, COLO.—It is reported that De Putron Glidden, representing an English company, is looking for a site to establish a pick factory in this city. The company which Mr. Glidden represents is the Federation Patent Pick Co., Ltd.

GILLETT, COLO.—It is stated that a large mill will be erected at this place. It is proposed to handle 125 tons of ore every 24 hours. Address J. D. Hawkins, of the El Paso (Colo.) Reduction Works.

WEST DENVER, COLO.—It is reported that an option has been secured by a railway company of 250,000 sq. ft. of ground, to be used as a location for the erection of a large smelter.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

GAS LIGHTING.—New York, N. Y.—Bids are asked until Dec. 17 for furnishing gas for lighting public buildings, etc., during 1896. Chas. H. T. Collis, Comr. Pub. Wks.

LEVEE WORK.—New Orleans, La.—Captain Derby has rejected the bids recently received for the following levees: Woodstock, Granada, Willow Grove, St. Gabriel, Dicharry and Bloomfield.

IRON POSTS, STREET LAMPS, ETC.—Cleveland, O.—Bids are asked until Dec. 18 for furnishing iron lamp posts, tin or brass lanterns and iron lantern supports, during 1896. W. P. Chard, Acting Dir. Pub. Wks.

MAUSOLEUM.—New York, N. Y.—Press reports state that Wm. Tyson Gooch, of Harding & Gooch, Archs., New York, is preparing plans for a $250,000 mausoleum, to be built in Greenwood Cemetery by John W. Mackay.

DRAINAGE DITCH.—Champaign, Ill.—Bids are asked until Dec. 21 for about 112,000 cu. yds. of ditch excavation, according to reports; check, $500; bond, $5,000. Robt. Penman, Chn. Embarras River Special Drainage District.

DAM, ETC.—Thief River Falls, Minn.—R. A. Lang, of Eau Claire, Wis., has the contract for river improvements, which include a dam, retaining walls, etc., on Thief River, at Thief River Falls, Minn. He will begin construction at once.

STONE.—New Orleans, La.—Bids are asked until Dec. 21 for building and placing mattresses loaded with stone at Plaquemine, Fla., and until Dec. 30 for furnishing and putting in place riprap and capping stones on jetty at Sand Island light station, Ala. Maj. James B. Quinn, U. S. Engrs.

FIRE APPARATUS.—New York, N. Y.—Bids are asked by the fire department until Dec. 23 for one second-size Clapp & Jones steam fire engine and one first-size La France steam fire engine; also for three second-size hose wagons and two third-size steel frame hook and ladder trucks.

GAS SUPPLIES.—Philadelphia, Pa.—Bids are asked until Dec. 17 for supplies for the gas department, including: Iron and steel, paints, brass supplies, wrought iron pipe, glass, cast iron pipe, lead, jute packing, me-

ters, etc.; also for repairing two stacks at Point Breeze works and for an additional holder at Germantown. Thos. M. Thompson, Dir. Pub. Wks.

LUMBER.—Albany, N. Y.—Bids are asked until Dec. 24 for furnishing and delivering timber and plank for the ordinary repairs on the several repair sections of the state canals. Specifications may be seen at the office of Thomas Wheeler, Asst. Supt. Pub. Wks., at Syracuse; at the office of R. G. Lay, Asst. Supt. Pub. Wks., at Rochester, and at this office. Geo. W. Aldridge, Supt. Pub. Wks., Albany.

DRAINAGE DITCH.—Lansing, Mich.—Geo. H. McIntyre, County Drain Comr., was in the city Dec. 5, according to local papers, arranging with the commissioner of Shiawassee county for the letting of a county drain in the townships of Locke, Perry and Woodhull. The proposed drain will be dug in the bed of the south arm of the Lookingglass River, will be about nine miles in length, and will cost $7,000 or $8,000.

PIER EXTENSIONS.—Philadelphia, Pa.—The board of port wardens has granted additional permits for piers, including licenses to the city of Philadelphia to extend to the new wardens' line the piers at Race, Arch, Chestnut and Dock Sts., and the same right to the Pennsylvania R. R. Co. to build three piers and platforms on piles on the east side of Delaware Ave., south of Walnut St.

GAS COMPANY.—Brooklyn, N. Y.—The Mutual Gas & Electric Co. has petitioned for a franchise. The company offers to furnish gas at reduced rates, and states that a $2,000,000 plant will be constructed if a franchise is granted. It is stated that a new process of gas manufacture will be used. Pres., A. W. Wanamaker; Secy., Nathan Leopold. Thos. Paterson and Bert Reiss are also interested. The seven gas companies of this city were bought by the Brooklyn Union Gas Co. about six weeks ago, and the price of gas to private consumers has been advanced.

CONTRACT PRICES.

SEWERS.—Cranford, N. J.—R. C. Plume, Clk., writes us that the contract for constructing sewers, as advertised in Engineering News, was awarded, on Dec. 9, to Fell & Costa, the bids being as follows; Carrol Ph. Bassett, Engr., Summit, N. J.:

Bids Received at Cranford, N. J., Dec. 3, for Constructing Sewers.

Quantities.		J. H. McKnight, Pittsburg, Pa.	P. H. Harrison & Sons, Newark, N. J.	Headley & Christie, Newark, N. J.	M. Honan & Sons, Trenton, N. J.	Fell & Costa, Orange, N.J.	Reinhart & Weaver, Allentown, Pa.
12-in. vitrified pipe	2,125 ft..	$0.54	$0.60	$0.48	$0.37	$0.60	$0.82
8-in. " "	25,750 "	.45	.44	.35	.55	.35	.68
Iron pipe	10 tons.	45.00	28.00	30.00	27.75	25.00	27.50
12-in. Y's	50....	.83	.65	.85	.95	1.00	1.06
8-in. Y's	400....	.83	.35	.45	.55	.50	.57
Manholes, less than 12 ft.	479....	3.00	2.50	2.25	2.95	2.25	2.75
Manholes, more than 12 ft.	50....	4.25	3.00	3.25	4.95	.25	3.00
Manhole buckets	83....	2.75	1.00	1.75	4.50	1.50	1.75
Manhole drops	50 ft..	.75	.50	1.50	.80	1.00	2.80
Lampholes	25 "	.50	1.00	.50	.87	.30	1.75
Silt basins	10....	4.00	8.00	4.00	2.50	2.00	27.50
Flushtanks, complete	20....	75.00	60.00	55.00	70.00	55.00	95.00
Concrete	100 yds.	4.25	4.50	3.00	4.60	.50	4.00
Iron castings	37,350	.02½	.02	.01¾	.01⅝	.02	.03
Excavation, below grade	300 yds.	.70	.30	.30	.57	.01	.90
Timber foundations	1,000 ft..	30.00	15.00	1.00	22.00	1.00	30.00
Sheathing	10,000 "	15.00	.50	1.00	5.00	10.00	30.00
4-in. underdrain	500 "	.15	.15	.49	.20	.30	.48
6-in. underdrain	1,000 "	.25	.20	.51	.25	.32	.54
Total		$24,157	$17,400	$14,978	$20,674	$14,551	$26,680

DREDGING.—San Francisco, Cal.—Maj. W. H. Heuer, U. S. Engrs., writes us that the following bids were received Dec. 2 for dredging in the Mokelumne River:

	Per cu. yd.
John W. Ferris, San Francisco	$0.12
John Hackett, San Francisco	.12
W. G. Witter and M. C. Harris, San Francisco	.15
J. C. Smith, Stockton, Cal.	.40

IRONWORK.—Charleston-Kanawha, W. Va.—The following bids were received at the U. S. Engineer office Dec. 7 for ironwork for movable dams, as advertised in Engineering News:

Bidders.	Wrot. iron, 311,000 lbs.	Drift bolts, 22,000 lbs.	Cast iron, 244,000 lbs.	Maneuvering winches, 3.	Total.
Ryan-McDonald Mfg. Co.	$.0495	$.022	$.02	$200	$21,358
Snead & Co. Iron Works	.0638	.022	.0197	165	25,628
John P. McGuire	.0546	.021	.021	95	22,852
Petersburg(Va.) Iron Wks Co.	.0529	.0379	.0207	135	22,741
Youngstown (O.) Bridge Co.	.0418	.0219	.0252	247	20,371
Fred J. Meyers Mfg. Co.	.05	.03	.0198	360½	22,123

INDUSTRIAL NOTES.

THE JUNCTION IRON & STEEL CO., of Mingo Junction, O., is adding two new mills to its plant for rolling merchant bar.

THE AMERICAN IRON & BOLT CO., of Cincinnati, O., has filed articles increasing its capital stock from $100,000 to $200,000.

THE SHICKLE, HARRISON & HOWARD CO., of St. Louis, Mo., is receiving many orders for its cast steel car body and truck bolsters.

THE EMAUS IRON WORKS, at Emaus, Pa., are making repairs to their plant, and expect to be able to resume work at an early date.

THE E. P. ALLIS CO., of Milwaukee, Wis., recently furnished a 750-HP. engine to the Junction Iron & Steel Co., of Mingo Junction, O.

THE SOUTH BALTIMORE CAR WORKS has received an order for 50 gondola cars of 60,000 lbs. capacity, for the Baltimore & Ohio Ry.

THE BIRMINGHAM ENGINE WORKS, of Birmingham, Ala., is building an addition, 100 × 250 ft., to contain new and improved machinery.

THE CHICAGO PNEUMATIC TOOL CO., of Chicago, Ill., recently sold six Boyer pneumatic hammers to Shickle, Harrison & Howard, of St. Louis.

THE DENVER & RIO GRANDE R. R. has placed orders with the Madison Car Co. for 350 30-ton freight cars and with the Ohio Car Co. for 200 cars.

THE DETWILER CO., of Toledo, O., has nearly completed all arrangements for erecting a new manufacturing plant for the construction of steel tubing.

THE PHOENIX IRON CO., of Phoenixville, Pa., recently received a third large order from Japan for solid upset steel eye-bars for bridges in Japan.

THE EAST CHICAGO IRON & STEEL CO., of East Chicago, Ill., has shut down its works, owing to its inability to pay its workmen, according to press reports.

THE POWERS TRIPLE-CYLINDER ENGINE CO., of St. Paul, Minn., is contemplating the erection of a plant for the manufacture of the new Powers steam engine.

THE PETERSBURG IRON WORKS CO., of Petersburg, Va., has a contract to build a 400-ft. flume for the Roanoke Rapids (N. C.) Power Co., to be 9 ft. in diameter.

WILBERFORCE SCULLY, of Pittsburg, Pa., is reported as having bid in the Carnegie furnace at Johnson City, Tenn., for $60,000, and will, it is understood, put the same in blast.

THE HAUGH-NOELKE IRON WORKS, of Haughville, Indianapolis, Ind., has completed its plant for the manufacture of architectural ironwork. Electricity will be used as the motive power.

HUNTINGTON & WYATT, engineers and contractors, of Pittsburg, Pa., have been awarded a contract for the erection of three Foote patent firebrick two-pass stoves for the Girard Iron Co., of Girard, O.

THE R. H. GAMBLE CO., of Lima, O., is the name of a new company, organized to publish city and county maps, and special maps showing telephone, electric light, water-works, or gas service, routes, etc.

McKINZIE & CO., of Elwood, Ill., have commenced work on their new boiler shops, and it is expected that the plant will be ready for operation within 90 days; 100 men will be employed at the start.

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THE HARTFORD WHEEL & MACHINE Co., of Morrow, O., has decided on moving its plant into the natural gas belt, according to current reports, and is considering a proposition from Anderson, Ind.

THE LITHO-CARBON RUBBER CO., of 47 Wall St., New York, N. Y., has completed a railway from its mines to connect with the Southern Pacific R. R., and is prepared to furnish asphalt in large quantities.

THE DIAMOND TRUCK & CAR GEAR CO., of Kingston, N. Y., is enlarging its plant by the erection of a building 250 × 60 ft., which, it is stated, will be equipped with the best class of machinery for building electric trucks.

THE BERLIN IRON BRIDGE CO., of East Berlin, Conn has just completed for the U. S. Projectile Co., at South Brooklyn, N. Y., the steel framework for a new annealing room. The building is 100 × 150 ft., and is designed to be a fireproof structure.

THE KENNEDY VALVE MFG. CO., 75 John St., New York, has just secured a contract to furnish New York city with 500 improved hydrants, this being the second large contract secured from the city this year, amounting in all to nearly $50,000.

W. D. ANDREWS & BRO., formerly of 233 Broadway, New York, N. Y., have had their property placed in the hands of Mr. Frederick W. Matticher, as receiver in supplementary proceedings for Wm. D. Andrews, of this company, on the application of Isaac G. Johnson.

THE ST. LOUIS SHOVEL CO., of St. Louis, Mo., recently lost by fire its main building; estimated loss between $80,000 and $100,000, covered by insurance. It is stated that the officers of the company have decided to rebuild at once, and to double the capacity of the plant.

THE JOSEPH DIXON CRUCIBLE CO., of Jersey city, N. J., informs us that its silica graphite paint will be used in painting all the tinwork and skylights of the post office department building at Washington, and will also be used on the capitol and the district government building.

THE BROOKS LOCOMOTIVE WORKS, of Dunkirk, N. Y., has begun delivery to the Lake Shore & Michigan Southern Ry. of the first installment of 10 freight locomotives on the July order for 35 engines. The company recently received an order for two freight locomotives from the Ohio River Ry.

THE FALK MFG. CO., of Milwaukee, Wis., has its machines at work on the lines of the Union Ry. Co., of Providence, R. I., putting in the Falk cast-welded joint, and will shortly commence work on the West End road, at Boston. The company will build several new machines during the winter, in anticipation of a much larger business next season.

THE INDIANA STEEL CO., of Indianapolis, Ind., is likely to be placed in a receiver's hands on the application of Wm. D. Kent, Robert Vierling, Louis Vierling and the South Halsted St. Iron Works, all of Chicago. The receivership is asked for in order to wind up the affairs of the corporation.

THE CROSBY STEAM GAGE & VALVE CO., of Boston, Mass., has brought out an electrical attachment to its well-known steam-engine indicator. The purpose of this new attachment is to enable engineers to procure simultaneous diagrams from compound engines, taking cards at the end of each cylinder.

THE TOLEDO BRIDGE CO., of Toledo, O., has increased its force to 500 men, and will soon add more according to press reports. Among recent orders may be mentioned the following: A bridge for the Boston & Albany R. R. at Natick, Mass.; another for Petroleum Center, Pa.; two at New Orleans, La., and four for the St. Louis & Kirkwood Electric Ry.

PICKANDS, MATHER & CO., of Cleveland, O., according to current reports, will soon invest for Mr. John D. Rockefeller, $1,250,000 in steel ships on the lakes, in addition to the large interests in lake transportation already owned by him. It is stated that another season will find Mr. Rockefeller the owner of some important blast furnace plants.

THE BATTLE CREEK STEAM PUMP CO., makers of the Marsh steam pump, at Battle Creek, Mich., has issued a circular letter in which it claims that the Marsh patent owned by them is the first which shows a steam-actuated valve which governs the engine, and declares that no steam-actuated governing valve can be made without infringing this patent.

THE BROOKLYN & NEW YORK RY. SUPPLY CO., of Brooklyn, N. Y., has filed a certificate of consolidation of the Lewis & Fowler Mfg. Co. with the Fowler Girder Rail Co.; capital stock, $200,000; Chas. C. Vanaughn, Jersey City; Frank A. Barnaby, of Plainfield, N. J.; Daniel F. Lewis, John J. Bryers and others, of Brooklyn; C. Edgar Battle, of New York, and others.

THE DORRANCE CO., of Chicago, Ill., has completed the installation of Dorrance grates on eight marine boilers at the Masonic Temple, Chicago. The installation of these grates is stated by the manufacturers to have resulted in doing with four boilers and slack coal the work formerly done by six boilers using gas fuel. The six boilers and gas fuel had previously replaced seven boilers using lump coal.

THE RAMAPO IRON WORKS, Hillburn, N. Y., are laying the foundation for a new shop 50 × 200 ft.; the north end, 50 × 100 ft., will be occupied as a machine shop, and the south end, 50 × 100 ft., as a blacksmith shop. The equipment is all on hand, and will be moved from the old shops, but will be operated by electricity in its new location. The old machine shop is to be torn down, and the shop now occupied by the blacksmiths will be used for the erection of frogs, crossings, slip switches, etc.

THE L. SCHREIBER & SONS CO., Cincinnati, O., has been awarded the contract for furnishing the material and erecting a 40 × 70-ft. water tower for the city of Cincinnati, O. Mr. Chas. C. Schreiber, Gen. Man., informs us that the company also has the contract for furnishing all the structural iron for, and the erection of, the new building of the National Cash Register Co., Dayton, O., to be 350 × 150 ft., four stories high; also the contract for the ironwork and the erection of the Reibold office and store building, Dayton, O., to be 10 stories high and fireproof. About 1,500 tons of steel will be used in the two buildings.

NEW COMPANIES.—The Clark Automatic Switch Co., Sioux City, Ia.; $50,000; incorporators' names not given.

Kansas City Stove Works, Kansas City, Mo.; $40,000; R. A. McKibben, J. A. Moore, Frank Kump and others.

The Nation Smoke Preventer Co., Detroit, Mich.; $10,000; Rod Dennin, Horace W. Avery and R. F. Roberts.

Oregon Mining & Water Supply Co., Tacoma, Wash.; $20,000; Wallace H. Jennings, J. T. Redmond and G. F. Shaw.

Manown Mfg. Co., Pittsburg, Pa.; $10,000, with $1,000 paid in; to manufacture firebrick, etc.; Treas., Thomas E. Young, Cleveland, O.

The National Pump Co., Kansas City, Mo.; $50,000, with $25,000 paid in; Michael Delaney, Thos. H. Howe, W. M. Morgan and others.

The Utica Drop Forge & Tool Co., Utica, N. Y.; $50,000; Wm. M. White, C. C. Kellogg, T. R. Proctor, H. L. White and John P. Campbell, of Utica.

The Erwin Mfg. Co., Greenbush, N. Y.; to manufacture bicycles; $5,000; John Erwin, W. W. Grey, of Albany, and R. J. Pratt, of Greenbush.

American Clay Refining Co., Kittery, Me.; $250,000; Pres., Harry F. Huestis, of Providence, R. I.; Treas., Albert J. Hoskins, of Hillsboro Bridge, N. H.

The American Machine Co., Cleveland, O.; to manufacture sewing machines, bicycles, etc.; $100,000; Frank Mack, Theo. Bucker, W. D. Williams and others.

The Revere & Winthrop Gas Co., Revere, Mass.; $50,000; Pres., D. Dudley Hannah; Treas., N. G. Nickerson; Arthur B. Curtis, Albert S. Burnham and others.

The Pacific Beach Mining & Dredging Co., Los Angeles, Cal.; $1,000,000; Anthony McNally, Thos. J. McCarthy, J. E. Lane, and others, of Los Angeles.

The Baltimore Glass Mfg. Co., Buffalo, N. Y.; $100,000; J. A. Oakes, and George Oakes, of Buffalo; S. B. Whittock, of Philadelphia, and John Pease, of Brooklyn.

White Fireproof Construction Co., New York city, $100,000; E. R. Freeman, U. S. Smith, New York; W. H. C. Delano, Brooklyn, and M. L. Freeman, of Netherwood, N. J.

Empire State Oil & Gas Co., Buffalo, N. Y.; $100,000; Porter A. Snyder and A. H. Marsh, of Fredonia; E. S. Vreeland, of Salamanca; W. A. Douglas, Charles J. Ellis, George N. Kneeland and Albert T. Fancher, of Buffalo.

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